G500

INSTRUCTIONS

BRISTOL'S® SERIES 500

INDICATING AND RECORDING PRESSURE GAUGES

BRISTOL
Division of AMERICAN CHAIN & CABLE CO.

THE BRISTOL CO.
WATERBURY, CONN. 06720

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INSTRUCTION BOOK NO. G500

ISSUE NO. 3

INDICATING AND RECORDING PRESSURE GAUGES
MODELS G500, G501, 12" SIZE
MODELS G530, G531, 8" SIZE

FOR SERIAL NO._____ CUST. ORDER NO._____

INDEX PAGE

THIS BOOK CONTAINS THE FOLLOWING INSTRUCTIONS IN THE FOLLOWING ORDER

ORDER IN BOOK	TITLE	NUMBER
1	Case Unpacking and Installation	Y19800
2	Recording-system Operation and Service	Y19802
3	Pressure-system Installation and Service	G6000
4	Parts List for Pressure-gauge Accessories	G6005
5	Parts List for Case and Recording Accessories	Y19807
6	Gauge Case Connections and Color Code	Sh-010776
7	Mounting Dimensions	Y19809
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
	PLUS FOLLOWING ITEMS AS REQUIRED	
	SPECIAL INSTRUCTIONS	
	WIRING DIAGRAMS	

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INSTRUCTION NO. Y19800

(Issue No. 5 of 6/54)

INSTALLATION AND SERVICE OF BRISTOL'S STANDARD MODEL 500 AND 530 CASES

TABLE OF CONTENTS

	Page
PART I GENERAL	2
A. Description	2
B. Accessories	2
PART II INSTALLATION	2
A. Location	2
B. Mounting the Case	2
1. Surface Mounting	2
2. Flush Mounting	2
3. Flush Mounting (Special)	2
PART III CASE CONNECTIONS	3
A. General	3
B. Standard Connection Sequence	3
C. Color Coding for Multiple-pen Recorders	3
D. Air-control Connections	3
E. Case-connection Fittings	3
PART IV CASE CHANGES AND SERVICE	3
A. General	3
B. Changing from Back to Bottom Connected	3
C. Changing from Bottom to Back Connected	4
D. Service and Repair	4

THE BRISTOL COMPANY WATERBURY 20, CONN.

PART I GENERAL

A. Description

Bristol's Model 500 and 530 Cases include many valuable features, such as uniformity of design and function, interchangeable mounting accessories (surface or flush), universal connection plates, etc. Case sizes are based on the nominal chart or dial dimensions. The Model 500 case is called the 12" case, and the Model 530 is called the 8" case.

B. Accessories

All Bristol Instruments are provided with mounting accessories for surface or flush mounting as specified on the sales order. In addition, other accessories, such as fixtures, extra parts, etc., may be supplied. These are always packed with the instrument and are itemized on the packing list. Do not throw away the packing until everything has been located and identified.

PART II INSTALLATION

A. Location of the Instrument

Select a location as free as possible from dust, dirt, corrosive fumes, vibration and extremes of temperature. Although Bristol instruments will operate satisfactorily under unfavorable conditions, the life and effectiveness of the instrument can be prolonged by using a recommended location.

B. Mounting the Case

Always mount the case vertically and level. Use a spirit level or plumb bob to check this. See Instructions Y19809 for mounting dimensions.

1. Surface Mounting. Surface mounting refers to any vertical surface, such as a wall, bracket or any other structure upon which the instrument may be fastened. Drill three 5/16" holes to take 1/4" bolts or wood screws according to mounting-dimensions drawing.

Attach the three brackets to the instrument in the surface-mounting position as shown in Figure 1 and fasten it securely to the surface.

2. Flush Mounting. Flush mounting means inserting the entire instrument into an opening so that only its door protrudes beyond the surface of the panel, wall or other mounting place. Cut out the hole in panel according to mounting-dimensions drawing. The maximum thickness of the panel cannot exceed 1 7/8" except for the bottom-connected 4-pen recorder with electric chart drive; this panel thickness cannot exceed 5/8".

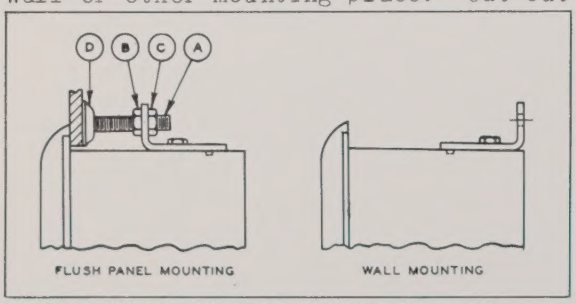

FIGURE 1. MOUNTING BRACKET POSITIONS

Allow horizontal space between instruments as specified in the mounting dimensions to give door clearance. Vertical space between instruments should not be less than 5" when they are flush mounted, back connected. Allow more between bottom-connected instruments.

After the hole is cut in the panel, remove the mounting bracket from the top of the case, unscrew all case connections (except thermometer tubing and filled pressure seals - see paragraph 3 below), and insert the back of the instrument thru the hole, bottom first. On thicker panels it may be necessary to remove all three mounting brackets. Have someone hold the instrument in front while the brackets are being replaced. After mounting brackets are replaced, loosen nuts B and C and screw A. Force screw A against reinforcing disc D. Turn nut B until snug against mounting bracket. Tighten screw A Lock in place by tightening nut C with a wrench. It is not necessary to tighten nut B with a wrench.

3. Flush Mounting of Bottom-connected Thermometers and Pressure Gauges with inseparable pressure seals. Case connections for these instruments cannot be removed, and extra clearance in panel cutouts must be allowed. See notes on mounting-dimensions drawing, Y19809. Gauges and thermometers in Model 530 (8") case may need wooden shims between the case bottom and the panel if the panel is over 1/2" thick. Be careful not to bend severely or pull on thermometer and seal tubing.

PART III CASE CONNECTIONS

A. General

The Model 500 and 530 cases are provided with a universal connection plate (Figure 2) which can be used for bottom or back connections and can be changed at any time.

Before making any connections to your instrument, check the voltage and frequency specified on the instrument nameplate and study the wiring diagram provided (wiring diagrams are generally not provided when the only electrical connections are for a chart drive).

B. Standard Connection Sequence

Measuring elements, chart drive, etc., are always connected in a standard sequence in Model 500 and 530 cases for gauges and thermometers. Separate diagrams are always furnished with gauges and thermometers, showing the standard connection sequence.

C. Color Coding for Multiple-pen Recorders

Each measuring system in Bristol's multiple-pen recorders is identified by a standard color code. The color for each system is listed on the instrument nameplate inside the case door. This color is painted on each pen arm, set-point index, set-point knob, case connection and also on thermometer bulbs (if used). The color of the recording ink also corresponds to the color code.

D. Air-control Connections

Case connections for supply and output air for pneumatic controllers are not made thru the universal connection plate, but at separate connections shown in the mounting dimensions for such instruments.

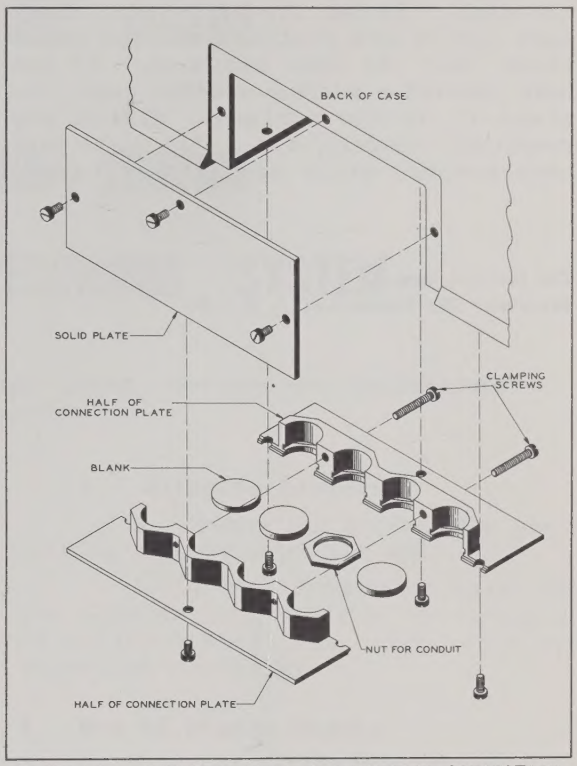

FIGURE 2. EXPLODED VIEW OF UNIVERSAL CONNECTION PLATE

E. Case-connection Fittings

A number of different fittings are available for standard conduit, pipe, electrical wiring, tubing, etc. A blank may be supplied to seal any unused connection holes.

PART IV CASE CHANGES AND SERVICE

A. General

Case-connection changes can be made without extra parts, using only a screwdriver. If different fittings are required (see paragraph D above), they may be ordered from Parts List Y19807.

All changes are made from the outside of the instrument case.

B. Changing from Back to Bottom Connected

Uncouple all inflexible connections to the connection plate, such as pipe, conduit, etc. (Do not attempt to remove thermometer tubing or other sealed systems.) Remove the solid plate from the bottom of the case by taking out the four screws holding it (a surface-mounted case will have to be removed from the surface upon which it is mounted). Then remove the three screws holding the connection plate, being careful to hold the plate so that it will not damage the tubing or other connections which cannot be removed. Do not unclamp the connection plate.

Now move the connection plate from the back to the bottom position, being careful not to damage the flexible connections. Fasten the connection plate into the bottom position and the solid plate into the back position. If you have removed a surface-mounted case, replace it on the surface. Attach any couplings, conduit, etc., that might have been removed while making the change.

C. Changing from Bottom to Back Connected

The same procedure outlined in paragraph B above is followed when changing from bottom to back connected.

D. Service and Repair

Parts List Y19807 gives a complete list of all the parts of the Model 500 and 530 cases. Order replacement and spare parts from this list.

The Bristol Company
Waterbury 20, Connecticut., U.S.A.

Printed in U.S.A.

INSTRUCTION NO. Y19802

OPERATION AND SERVICE OF ROUND-CHART RECORDING SYSTEM

NOTE: This instruction covers only the recording system. See separate instructions covering the measuring system, control system, etc.

A. Unpacking

1. Standard Recorder Accessories. Every Bristol round-chart recorder is supplied with one of each of the following items:

Box of 100 charts, range and chart number as ordered.

1-ounce bottle of ink with dropper. Multiple-pen instruments get a 1-ounce bottle of different color ink for each pen supplied.

Pen cleaner wire (.045" diameter) with instructions in envelope.

Brass chart-drive key (spring drive only).

FIGURE 1. QUICKSET CHART HUB - OPEN

2. Shipping Devices

a. Remove and discard the paper packing support under pen arm.

b. Remove from under chart hub the circular instruction on the operation of Quickset chart hub. Read this instruction carefully.

B. How to Change Charts

1. Push pen lifter down in order to hold pens and pointers away from chart.

2. Tip up Quickset chart hub, as shown in Figure 1, and slip off the old chart.

3. If instrument has a spring chart drive, wind chart drive by inserting brass key thru hole in chart plate.

4. Slip new chart over chart hub, under slot (18) in chart plate and under time index (3). Turn chart by hand until time index points to correct time. **Note:** Pens on multiple-pen recorders, in order

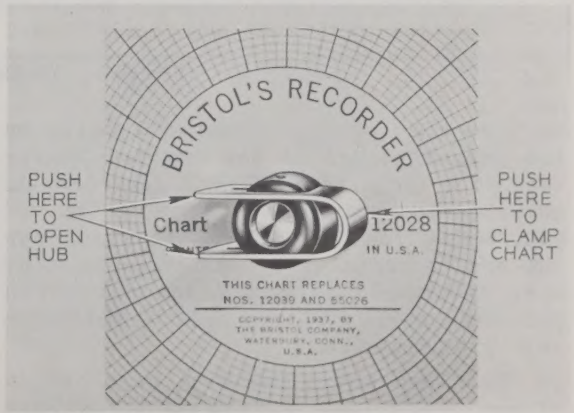

FIGURE 2. QUICKSET CHART HUB - CLOSED

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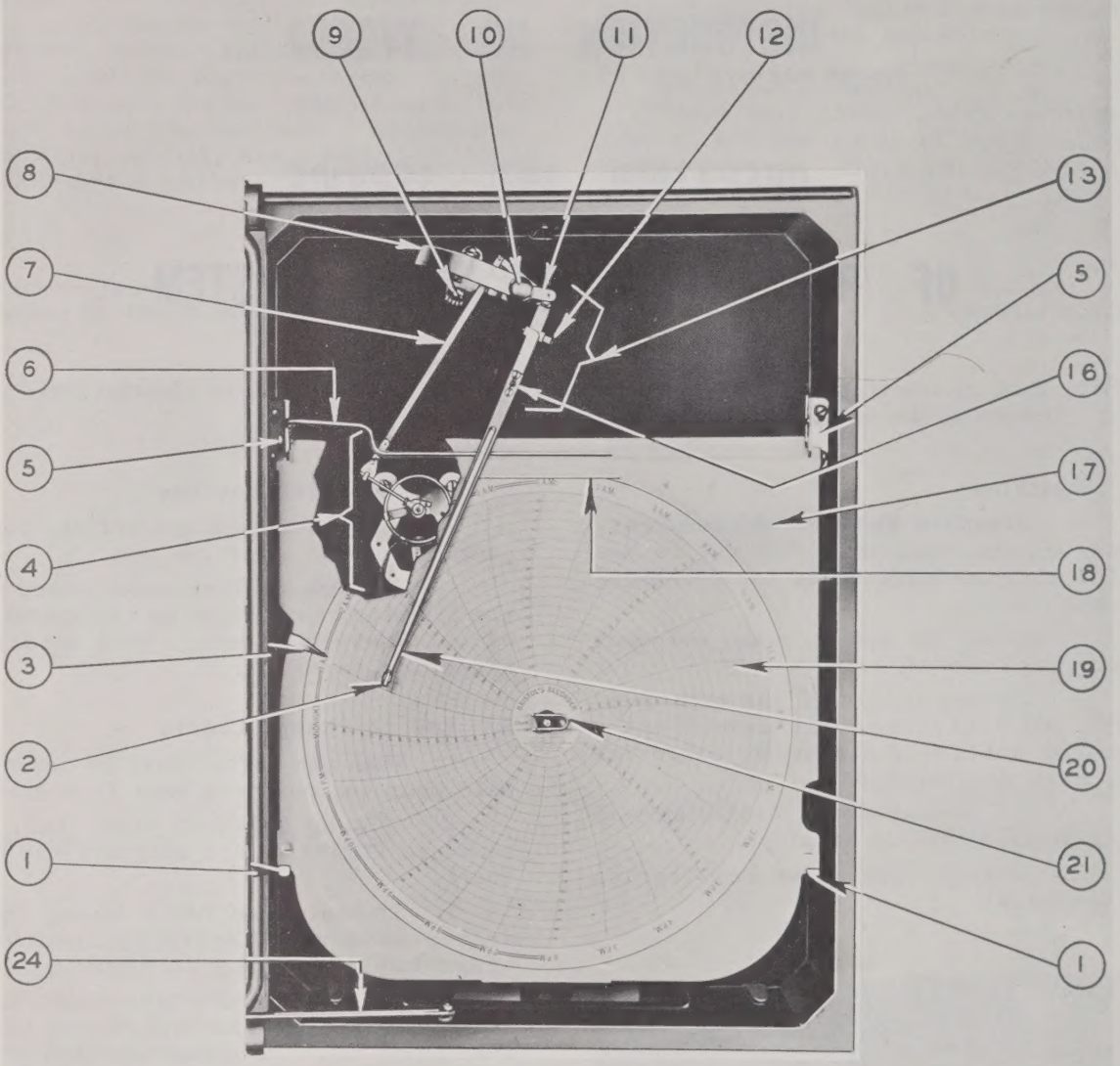

FIGURE 3. TYPICAL SERIES 500 RECORDER

to pass each other, cannot all swing on the same time arc of the chart. Therefore, the time index on such recorders is adjusted to indicate the time of the red pen, which is the only pen that follows the arc of the chart. Allowance must be made for this time difference between pens when reading charts made by multiple-pen instruments.

5. Turn chart hub down as shown in Figure 2 and push firmly on its curved end in order to hold chart. **Note:** Dairy recorder chart hubs are made with a pin which perforates the chart to prevent its being rotated by hand once it has been clamped down. Be sure to turn chart of dairy recorders to correct time at time index before pushing chart down over pin.

6. Add ink to pen or pens per paragraph C.2, page 3.

7. Lower pen or pens gently onto chart by pushing pen lifter upward.

Code To All Photos

1. Spring catch for chart plate
2. Pen
3. Time index
4. Measuring element
5. Chart plate bracket
6. Pen lifter
7. Measuring element connecting link
8. Universal pen mounting
9. Screws holding above
10. Cap screws holding tabs
11. Bearing tab
12. Micro adjustment
13. Base end of pen
14. Pen shaft lever
15. Pen shaft
16. Screws holding pen arm
17. Chart plate
18. Slot to hold top of chart
19. Recording chart
20. Pen arm
21. Quickset chart hub
23. Universal connection plate
24. Door stop
30. Speed regulator of spring chart drive
31. Start knob
32. Screws holding spring drive in case
33. Winding arbor
34. Screws holding drive cover
35. Gear change speed indicator
36. Gear change knob
37. Spring drive cover
40. Laminated core
41. Name plate of telechron motor
42. Gear train
43. Electric drive mounting plate
44. Electrical connection wires
45. Screws holding drive in case
46. Electric drive terminals
50. Shipping strap of complete motor unit
51. Motor shaft
52. Screws holding shipping strap
53. Rotor unit
54. Soldering lugs
55. Field coil
56. Location of "top" marking & rotor data
57. Rotor pinion gear
58. Screw holding motor into gear case
59. Copper shading coils

C. Pens

1. Types

a. Single-pen Recorders. Single-pen recorders are supplied with either a "V" pen or a fountain pen. Fountain pens and V pens are not interchangeable. A special fine-bore fountain pen is sometimes used for recording variables which change widely and often. If the ink record of your recorder tends to overlap and run, a fine-bore fountain pen should be obtained to replace the standard-bore fountain pen. For records of very long duration, standard-bore and fine-bore pens are available with large barrels holding 6 drops of ink. All standard- and fine-bore, 3- and 6-drop fountain pens are interchangeable.

b. Multiple-pen Recorders. Multiple-pen recorders are supplied with flattened fountain pens with capillary tips of different lengths so that they can pass each other on the chart. The pen nearest the chart is called the 1st pen, the next pen is called the 2nd pen, etc. Be careful not to bend pens (or pen arms) of multiple-pen recorders as they must pass each other without touching. Multiple-record instruments are supplied with a maximum of 2 pens on the 8" size case and 4 pens on the 12" size case.

All pens should be replaced as soon as the tip is worn, broken or corroded.

See parts list of recording accessories for complete listing of pens.

2. How to Ink and Start Pens. Pens, as supplied, usually will hold more than enough ink for one complete chart revolution. However, it is wise to refill pens every time the chart is changed.

a. V Pen. Fill V pens 2/3 full, using dropper from ink bottle supplied. If pen fails to trace when lowered on chart, touch its tip with a moistened finger.

b. Fountain Pen. Fill fountain pens to the top, using dropper from ink bottle. Standard pens take about 3 drops of ink. If pen fails to trace when lowered on chart, try touching tip of capillary tube with a moistened finger. If pen still fails to trace, pull pen off pen arm and squeeze between thumb and finger (as per Figure 4), then dip end of capillary tube in a drop of ink and release pressure of fingers. Replace pen by pushing pen all the way up on forked end of pen arm.

Use the 1-ounce bottle and pen filler furnished for re-inking pens. See parts list of recording accessories for complete listing of all inks, bottles, and pen fillers.

c. Capillary Pen. Covered by separate instructions Y19803-1.

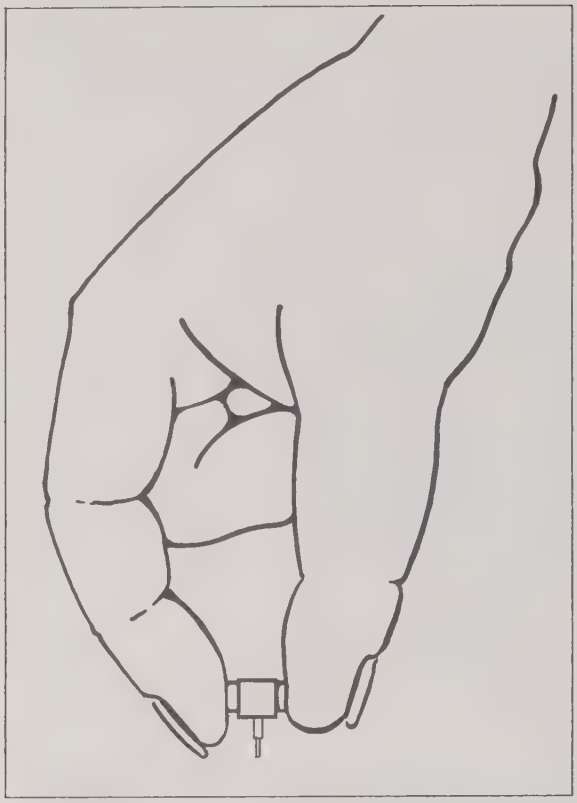

FIGURE 4. STARTING FOUNTAIN PEN TO INKING

3. How to Clean Pens. Pens should be cleaned periodically to forestall trouble because only a clean pen can trace a clean record.

To clean either a V pen or a fountain pen, loosen screw (16) holding pen arm and pull pen arm and pen off of base end (13). Wash pen in hot water (if necessary, boil pen in water for a few minutes).

Clean out capillary tip of fountain pen by inserting pen cleaner wire supplied.

Replace pen arm and pen, being sure to push prongs of pen arm up under rivets on base end until it snaps into place. Retighten locking screw.

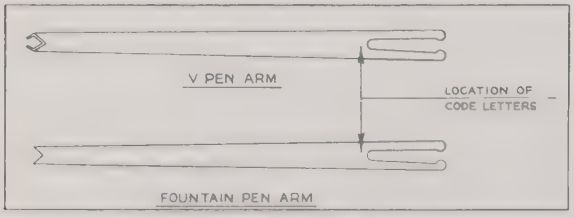

FIGURE 5. PEN ARMS

D. Pen Arms

Pen arms for V pens and for fountain pens (see Figure 5) are not interchangeable. Pen arms for 1st, 2nd, 3rd and 4th pens of multiple-pen recorders are of different lengths and, therefore, are not interchangeable.

All Bristol pen arms are identified by code letters stamped into their upper ends. Be sure to specify these code letters from your old pen arm when ordering replacements.

Do not bend pen arms. If the effective length of the pen arms is altered, the pen will not swing along the time arc on the chart and, therefore, will not record the measured variable correctly. If pen arms of multiple-pen recorders are bent, they will not pass each other freely.

E. Removing Chart Plate

The chart plate of Series 500 recorders can be removed without tools in the following manner:

Raise pen or pens by pushing down on pen lifter. Tilt up chart hub and remove chart. With thumbs of both hands, depress simultaneously 2 clips (Item 1 of Figure 3) and pull bottom of chart plate out and

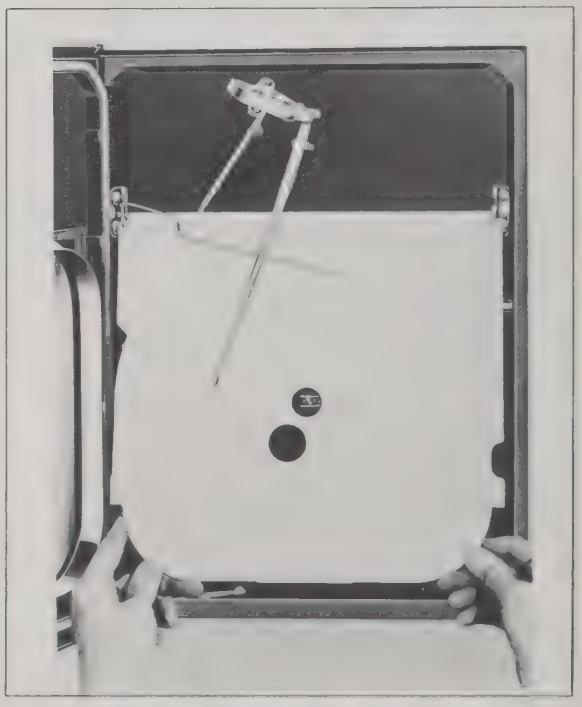

FIGURE 6. HOW TO REMOVE CHART PLATE

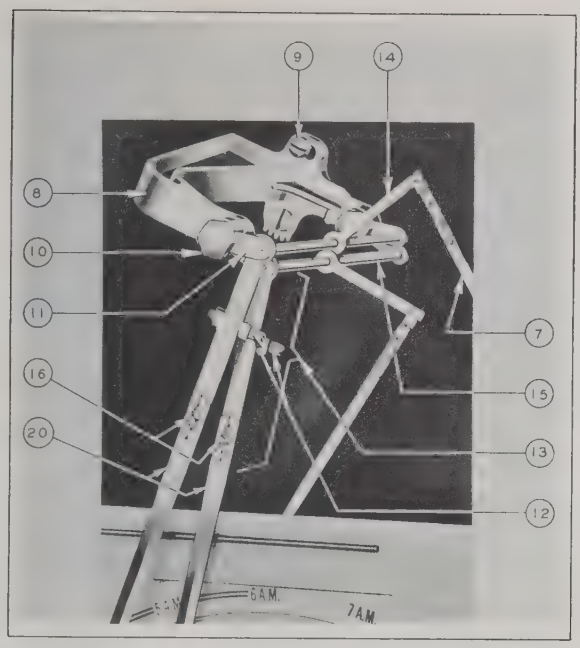

FIGURE 7. UNIVERSAL PEN MOUNTING - 2 PEN

down (see Figure 6). Chart plate may be replaced in the reverse order to above.

F. Pen Mounting and Base Ends

All Series 500 recorders are equipped with the same style universal pen mounting. Mounting parts can be easily replaced or mounting can be quickly converted to accommodate any multiple combination.

On most recorders the pen shaft (Item 15, Figure 7) can be removed by gently lifting top bearing tab (11) and slipping shaft out. Pen mounting can be disassembled by removing 2 screws (10).

Micro adjustment (12) is spring loaded to eliminate all lost motion. Its knob is both knurled and slotted for easy adjustment with fingers or a screwdriver. See measuring-system instructions for this adjustment.

A complete listing of all pen-arm mountings and parts is given in parts list for recording accessories.

G. Ink

1. Standard Color Code. The color of ink to be used in each pen of multiple-record instruments is indicated on its pen arm or base end.

2. Standard Ink. Standard Bristol recorder ink will perform well at internal case temperatures from +10°F to +160°F (-12.22°C to +71.11°C).

3. Low-temperature Ink. Bristol low-temperature ink is recommended for case temperatures from -65°F to +80°F (-54°C to 26°C). It will flow evenly and will not freeze at these temperatures.

4. High-temperature Ink. Bristol high-temperature ink is recommended for case temperatures from +60°F to +500°F (+15°C to +260°C). This ink will not dry in pens or boil away when used between these temperatures.

5. Quick-Drying Ink. This type of ink is recommended with high speed charts (15-, 30- and 60-minute rotation) because it dries quickly and permits charts to be removed immediately when finished without smearing the record.

Quick-drying ink is also recommended where high humidity conditions exist.

Note: Use only Bristol recorder inks. Ordinary inks dry too fast, clogging and corroding pens. A complete listing of Bristol Company inks is given in parts list for recording accessories.

H. Chart Drives

All Bristol chart drives for round-chart recorders have identical mountings and are, therefore, interchangeable. Thus, chart rotation time or voltage and frequency used can be quickly changed. Spring and electric drives are also interchangeably mounted.

1. Service Chart Drives. All Bristol Branch and Main Factories carry stocks of carefully rebuilt, fully guaranteed spring and electric chart drives which will be exchanged for the same specification defective drive for a nominal charge. In

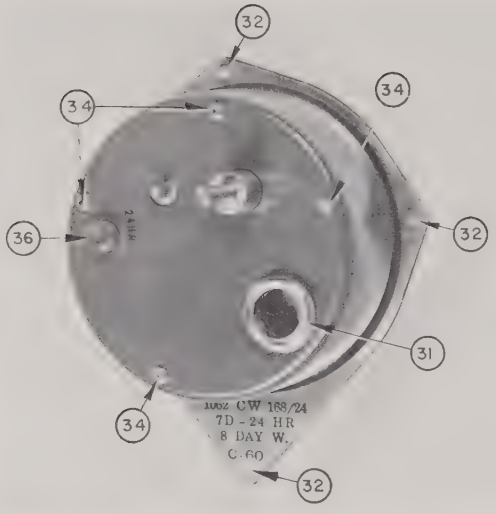

FIGURE 8. SPRING CHART DRIVE COMPLETE

order to positively identify correct speed, gear ratio, voltage and frequency, etc., we must receive your old chart drive before shipping the replacement service drive.

Instrument users having several Bristol recorders would do well to keep one or two, two-speed spring service chart drives in stock as universal standby replacements.

2. Spring Chart Drives

a. How to Wind. With chart removed, insert brass key thru hole in chart plate and wind arbor clockwise as far as it will turn. Wind all 7 and 8 day spring chart drives once each week. All other drives must be wound once each day.

b. Adjusting Speed. If chart revolves too fast or too slow, the speed of chart drive should be adjusted by turning adjusting lever in the direction required. Moving the lever clockwise makes the drive go faster and moving the lever counterclockwise makes the drive go slower. Cap (item 31, fig. 8) must be removed to get at adjusting lever.

c. Two-speed Drives. Some spring chart drives are equipped with a gear changer to produce two different chart rotations, for example: 24 hour and 7 day. To change from one rotation to the other, turn knob (Item 36, Figure 8) in a direction to show the desired rotation time.

d. Lubrication. Under normal conditions a spring chart drive should be cleaned and oiled about once a year. Where severe conditions exist, more frequent cleaning and oiling will be required. Only an experienced clock worker with proper equipment should be allowed to completely service a chart drive. Unless such are available, we recommend that chart drives be returned to The Bristol Company for exchange. (See "Service Chart Drives" paragraph H.1.)

For servicing spring chart drives, proceed as follows:

1st. Remove 3 mounting screws (32) and take complete chart drive out of instrument case.

2nd. Remove chart hub by loosening its setscrew with a small screwdriver.

3rd. Remove 4 nuts (34) and pull off cover.

4th. Disassemble movement and soak all parts **except** main spring assembly in benzine. Shake off excess benzine and allow all parts to dry thoroughly.

5th. Oil the main spring liberally with Bristol clock oil, Part No. A3885.

6th. Reassemble movement completely.

7th. Apply a small amount of Bristol clock oil to each bearing with a toothpick. For internal case temperatures from -20°F to +120°F use Bristol Part No. A3885 oil.

8th. Replace chart-drive cover, being careful to correctly position start lever and gear-shift knob. Replace chart hub and remount drive in recorder case.

3. Electric Chart Drives.

Electric chart drives are powered by a 2-watt, self-starting synchronous motor which depends for its timing on the frequency of the alternating-current supply. Therefore, the frequency must be exactly as listed on name plate to obtain accurate chart timing. Where frequency is unregulated, we recommend use of spring chart drives.

Most recorders require power-supply wires to be connected directly to the terminal block on the chart drive.

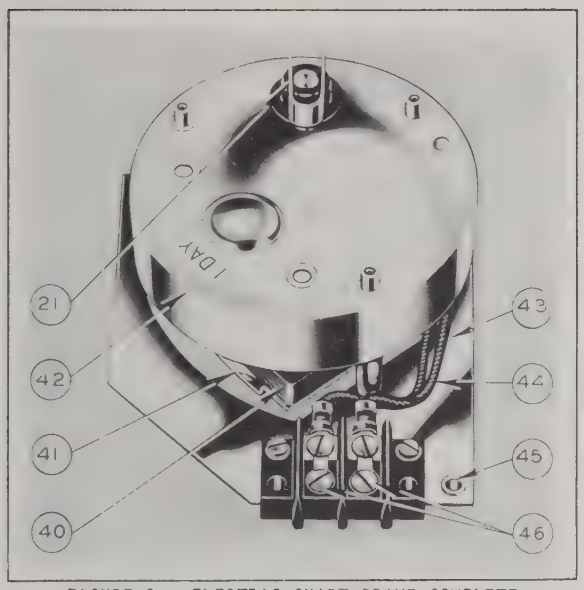

FIGURE 9. ELECTRIC CHART DRIVE COMPLETE

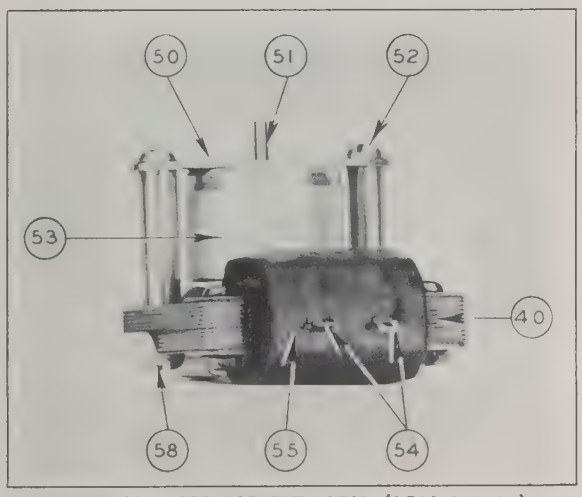

FIGURE 10. REPLACEMENT MOTOR (LESS PINION)

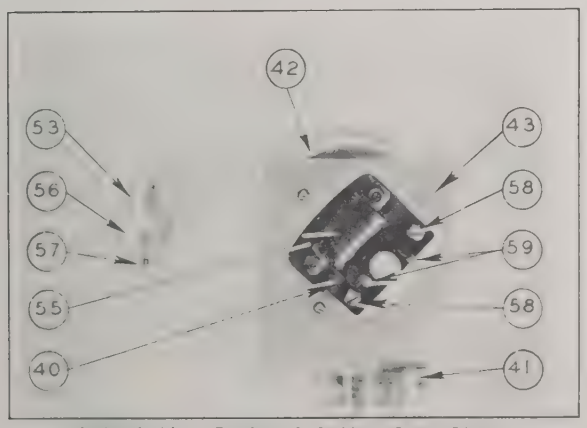

FIGURE 11. ELECTRIC CHART DRIVE PARTS

Caution: Before connecting power supply to chart drive, be sure to check on chart-drive base plate for correct voltage and frequency.

A supply-voltage variation of plus or minus 10% or less will not affect accuracy of timing.

There is no starting knob or speed regulator on electric chart drives. Electric chart drives will restart automatically after power failure, but the lost time must be made up by manually advancing the chart to correct time.

The Bristol Company can supply a reactor for installation in the chart-drive supply circuit to permit a 120-volt chart drive to operate on a 240-volt supply. This is especially convenient for portable test recorders, which can thus be operated from either 120- or 240-volt supply lines.

a. Replacement of Parts. Electric-chart-drive parts are supplied in three arrangements:

1. Complete drive as in Figure 9.
2. Motor unit complete as in Figure 10.
3. Rotor and pinion only shown in Figure 11. (Items 53, 56 & 57).

See parts list for complete chart-drive listing. As a rule either the motor complete or the rotor only need be replaced because of wear. Motor complete is furnished with shipping plate and screws to hold it together during shipment. These should be removed and discarded when motor unit is put into use.

By changing motor units and/or rotor units, any electric chart drive can be rebuilt to produce any standard combination of voltage and frequency. In ordering replacement parts, specify all data on the motor name plate. In ordering rotors, specify all data stamped on its barrel. Direction of rotation can be reversed by turning over the laminated magnet and field coil assembly (Items 40 and 55).

b. Disassembly of Chart Drive. Turn off power supply and disconnect leads from terminals. Unscrew 3 screws (45) and remove complete chart drive from

instrument case. Turn chart drive upside down and remove 2 screws (58) which permits rotor and motor to be removed from gear train. Note carefully position of the 2 copper shading coils (59) on laminated core before disassembly.

Replace rotor, motor, etc., as required and reassemble. Be sure to replace laminated magnet with copper shading coils (59) in same position as before. The direction of rotation of the rotor and consequently that of the chart can be reversed by turning magnet over and installing it with shading coils in the reverse position.

Note that the rotor has the word "top" stamped into edge of barrel. In assembling, turn rotor so "top" will be uppermost when chart drive is mounted in the instrument case to assure proper lubrication.

Replace chart drive in case and reconnect to power supply.

c. Lubrication. Rotor unit never requires lubrication. After 2 or 3 years use, the gear train only (motor and rotor removed) should be cleaned with benzine, allowed to dry and then oiled with Bristol clock oil Part No. A3885.

4. Combination Electric and Spring Chart Drives. A combination electric and spring chart drive is designed so that if the electricity fails, the spring movement will take over to drive the chart.

The instrument, when first received, will have its spring movement fully unwound. When the electric power supply (120 V. 60 cy.) is applied to the chart drive, the electric movement will automatically wind up the spring movement. It will take approximately 30 hours for the electric drive to fully wind up the spring movement. When fully wound and with the electric power off, the spring drive will operate continuously for at least 24 hours.

The chart drive is fast in transition from electric to emergency spring operation and vice versus. The balance wheel is held at peak tension by a magnetic field while the electric unit is in operation.

Note: On instruments shipped prior to Sept., 1962 the dual drives had to be manually wound with a key. These models were provided with a signal in the form of a red disk which indicated the spring needed rewinding.

J. Repairs, Correspondence and Shipping

Address all correspondence and orders to the nearest Branch Office.

Ship all parts for repair or exchange only to Bristol Branch or Main Factory, never to Branch Offices. Identify all shipments fully, including your exact return address and repair order number. Be sure to state model and serial number of instrument in all orders and correspondence.

Addresses and phone numbers of Bristol Field Organization are listed on the last page of all instruction books.

The Bristol Company
Waterbury, Connecticut 06720

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INSTRUCTION NO. G6000

(Replaces issue of 10/61)

INSTALLATION AND SERVICE OF SERIES 500 PRESSURE MEASURING SYSTEMS USING HELICAL AND CAPSULAR TYPE ELEMENTS

TABLE OF CONTENTS

	Page
PART I GENERAL	3
A. Helical Elements	3
B. Capsular Elements	3
PART II INSTALLATION	3
A. General Installation Instructions	3
1. Case Pressure Connections	3
2. Gauge Lines	3
3. Gauge Cock and Tee	3
B. Gauge Installation under Special Conditions	3
1. Pulsating Pressures	4
2. Corrosive Pressure Media	5
a. Liquid Seals	5
b. Capsule-type Seals	7
c. Purge Systems	7
d. Corrosive-resistant Elements	7
e. Ammonia Gauges	7
f. Mercury Amalgamation	7
3. Viscous or Solidifying Fluids	7
a. Capsule-type Seal	7
b. Heated Gauge Lines	7
4. Freezing Ambient Temperatures	7
5. Pressure Media Containing Solids	8
a. Sump	8
b. Purge Systems	8
c. Installation and Operation of Purge System	8
6. Mechanical Protection of Pressure Element	12
a. Element Stop	12
b. Spring Link	12
7. Corrections for Level	12
a. Gauge Mounted Below Point of Measurement	12
b. Gauge Mounted Above Point of Measurement	12
c. How to Make Level Corrections in the Field	12
8. Overrange Protection	13
a. Low-range Gas Gauge	13
9. Partial Ranges	13
10. Filling Gauge Lines	13
a. Gauge Mounted Below Connection	13
b. Gauge Mounted Above Connection	13

- Continued on Page 2 -

- TABLE OF CONTENTS - -continued-

Page

11. Gauges Measuring Gas and Air 14
12. Gauges Measuring Liquids 14
13. Gauges Measuring Steam or Hot Condensable Vapors 14
    a. Gauge Mounted Below Connection 14
    b. Gauge Mounted Above Connection 14
14. Compound Pressure and Vacuum Gauges 14
15. Explosive or Inflammable Pressure Media 14
16. Case Purging in Explosive or Corrosive Atmospheres 14
17. Ambient-pressure Effects on Low-range Gauges 15

PART III SERVICE 15

A. Checking and Calibrating Pressure Gauges 15
    1. Zero Check 15
    2. Comparison with Test Gauge 15
    3. Laboratory Calibration 15
    4. How to Calibrate Bristol Gauges 15
        a. Mechanical Alignment 15
        b. Span Adjustment 16
        c. Linearity Adjustment 16
    5. Test Gauge Manifold 16
B. Replaceable Pressure Elements 17
    1. Changing Ranges 17
    2. Standby Pressure Elements 17
    3. How to Remove Pressure Elements 17
    4. How to Install Replacement Elements 17
    5. How to Order Replacement Pressure Elements 17
C. Lubrication and Cleaning 17
D. Factory Repair of Gauges 17
E. Repairs, Correspondence and Shipping 17

Note: This instruction covers only the pressure measuring system. See separate instructions on unpacking, mounting case, recording system, controlling system, etc. This instruction covers single and multiple pressure systems as used in indicating, recording and controlling pressure gauges, liquid-level meters, or as pressure pens in thermometers, flowmeters, etc. If yours is an indicating instrument, please ignore reference herein to pen, chart, etc.

PART I GENERAL

The pressure measuring system includes the pressure element (either helical or capsular), element mounting, span adjustment, tubing for coupling the element to the case connection, and the case connection. The ranges listed below apply to 500 Series cases only.

A. Helical Elements

Helical elements (Figure 1) are supplied for ranges of 0-31 psi up to 0-30,000 psi. These elements are mounted on one style of universal element mounting and are made in several alloys. Some of the alloys used and their ranges are listed above.

Helical Element Material	Ranges in PSI
Trumpet metal	0-31 to 0-500
Beryllium copper	0-31 to 0-10,000
Type 316 stainless steel	0-31 to 0-30,000
Ni-Span C	0-31 to 0-15,000

B. Capsular Elements

Capsular elements are made of phosphor bronze in ranges from 0-1" wtr. to 0-30 psi, Ni-Span C ranges 0-4" wtr. to 0-210 psi, type 316 stainless steel ranges 0-2" wtr. to 0-40 psi, and for all vacuum ranges from 0-1" wtr. to 30" mercury. Figure 2 illustrates the type of capsular element used on all but the extremely low ranges. The capsules used on the extremely low ranges (ranges below 0-2.9" wtr. for phosphor bronze and below 8" wtr. for stainless steel) are quite large in diameter and require a special housing to provide adequate support.

PART II INSTALLATION

A. General Installation Instructions

(Pressure measuring system only, see separate instructions for installation of all other parts.)

1. Case Pressure Connections. Remove and discard the plastic plug from the case connection. Screw a union into the case connection plate which may be mounted for back or bottom connection, as desired. Be careful not to exert too much force or the case fittings may be broken.

The proper case connection position into which pressure connections are to be made is given on Sheet 010776 included with all gauge instructions.

2. Gauge Lines. Gauge lines are the tubing or piping used to connect the source of pressure (tank, vessel, etc.) to the pressure gauge.

Flexible copper tubing and compression fittings are recommended for most installations, particularly on very low pressures and high vacuums where no leaks can be tolerated in gauge lines or connections. For rigidity or better appearance, brass or steel pipe and fittings may be used. In any event, gauge lines must be adequate to withstand the pressure and corrosion of pressure media being measured.

The speed of response of pressure gauges is affected by the internal size and the total length of the gauge line. In most gauge installations, speed of response is of no consequence. However, in applications using controlling gauges, low range or vacuum gauges, the size and length of gauge lines must be carefully considered in order to avoid objectionably slow response. See table in Figure 4 for recommended pipe or tubing sizes.

3. Gauge Cock and Tee. It is strongly recommended that a 2-way gauge cock (similar to Crane #744 - 1/4" IPS thread) be installed in gauge line close to gauge (see Figures 5 and 6). This enables line to be shut off, permitting service to or removal of the gauge without shutting down the process. If gauge check, calibration or filling of gauge lines will be required, install a 1/4" tee and plug between cock and gauge (see Figure 5 or 6).

B. Gauge Installation under Special Conditions.

Conditions under which pressure gauges are used are so varied that it is impossible to provide exact instructions for all installations. A study of the following instructions will suggest many precautions and corrections to observe for most special applications. Whether or not these precautions should be observed depends on the range concerned and the accuracy required.

1. Pulsating Pressures. Pulsating pressures in the pressure medium being measured are objectionable for three reasons:

a. The constant swinging of the pen will trace a wide, unreadable chart record and will wet the chart with an excess of ink.

b. Violent pulsations will fling ink out of the pen.

c. Constant motion of the measuring system will cause excessive wear of bearings and may cause loss of calibration or eventual rupture of the pressure element.

Pulsations are usually produced by reciprocating pumps, compressors, or engines. Hydraulic pressure surges (water hammer, etc.) must not be permitted to enter gauge. Even where hammer is only occasionally experienced, the gauge must be protected.

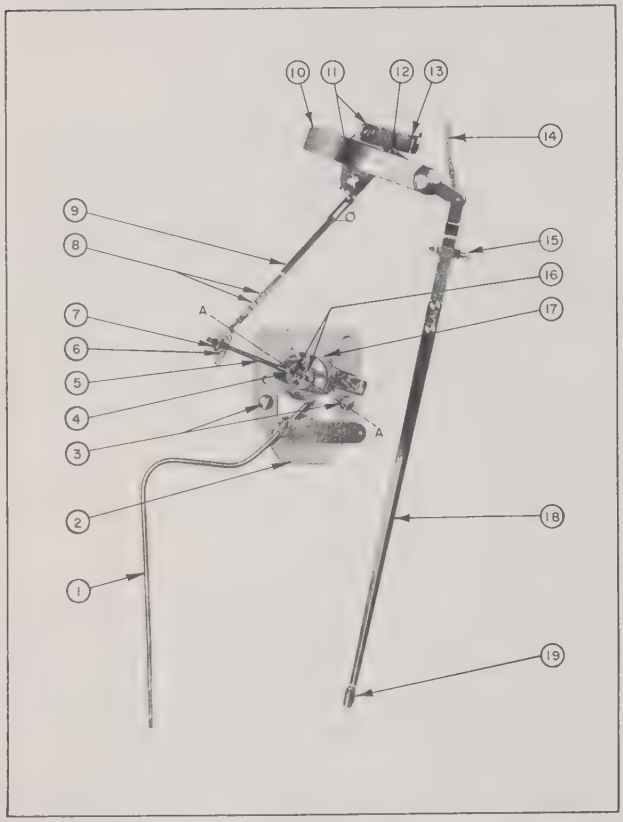


FIGURE 1. HELICAL TYPE PRESSURE MEASURING SYSTEM SHOWING PEN STOP AND SPRING LINK

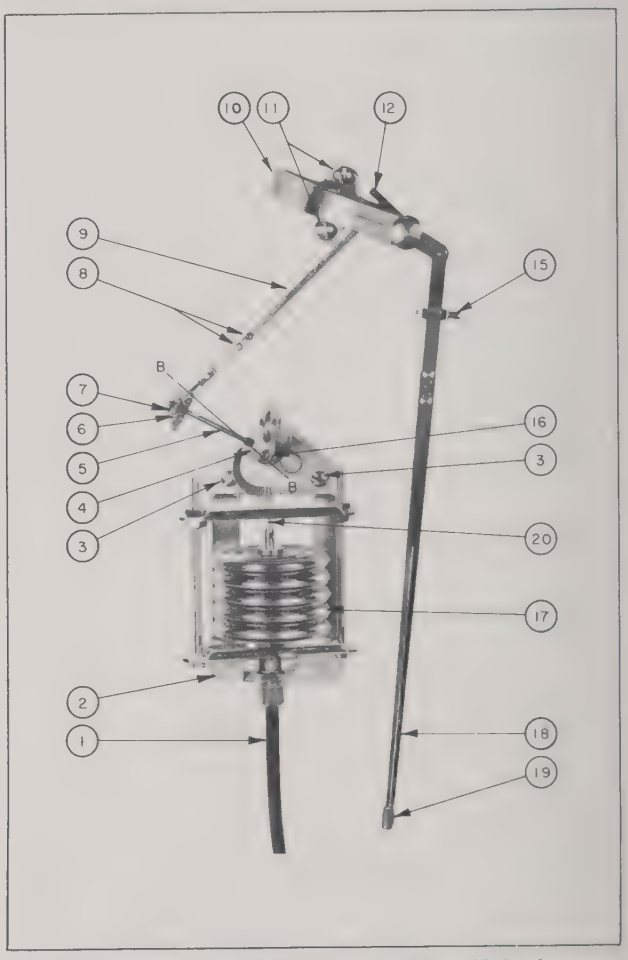


FIGURE 2. CAPSULAR TYPE PRESSURE MEASURING SYSTEM.

CODE TO FIGURES 1 & 2

1. Tubing leading to case connection
2. Pressure element mounting
3. Element mounting screws
4. Friction disk for coarse zero adjustment
5. Lever arm
6. Locking screws
7. Span adjustment
8. Locking screws
9. Linearity adjusting link
10. Pen mounting
11. Pen mounting screws
12. Pen shaft lever
13. Adjustable pen stop
14. Adjustable pen stop lever
15. Pen zero adjustment
16. Locking screws (coarse zero adjustment)
17. Measuring element
18. Pen arm
19. Pen
20. Connecting rod

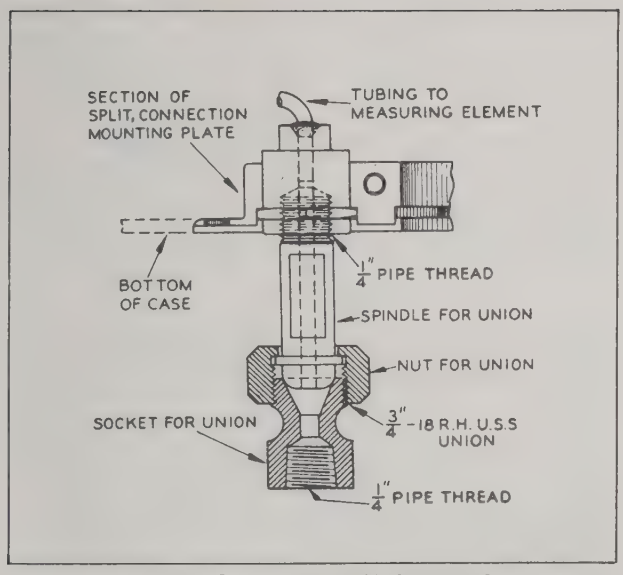


FIGURE 3. STANDARD GAUGE UNIONS

Pulsations and surges can be damped out by restrictions or capacity in gauge lines. Such damping produces a pressure which is not a true average of the instantaneous pressures but may vary several percent from the mathematical average.

The simplest pulsation damper is a 1/4" needle valve installed in the gauge line several feet from the gauge to provide some restriction. The needle valve should be closed slowly until the pen records an even line and yet responds to significant average pressure changes. If the gauge line between needle valve and gauge does not contain sufficient capacity to damp out pulsations, a capacity tank made of 2" pipe and pipe caps can be installed in the gauge line as per Figure 7.

For more violent pulsations, a specially designed pulsation damper is offered. Install this damper as close to gauge as possible, making connections as shown in Figure 8. To adjust damper, loosen packing nut, turn adjusting screw until closed. Then back off adjusting screw by steps, 1/2 turn back, 1/4 turn forward, 1/2 turn back, etc., until pen records an even line, yet responds with sufficient speed to record desirable normal pressure changes.

Retighten packing nut after adjustment.

See Parts List G6005 covering pressure gauge accessories for part numbers of needle valves and dampers.

2. Corrosive Pressure Media. Corrosive pressure media must be excluded from pressure gauges, unless they are equipped with special non-corrosive elements and tubing. Three methods of excluding corrosive pressure media are described below.

a. Liquid Seals. The type of seal and sealing liquid to use depends upon pressure, specific gravity and corrosive nature of the pressure medium being measured. The sealing liquid is selected for the following four properties:

1. Resistance to chemical combination with pressure medium.

2. Resistance to physical combination with pressure medium, such as evaporation, amalgamation or dissolving.

3. Specific gravity which will keep sealing liquid separate from pressure medium under all existing temperatures. Note that sealing liquid may be either heavier or lighter than pressure medium.

Pressure Range From	Length of Gauge Line	RECOMMENDED GAUGE LINE SIZE	
		Std. Pipe	Copper water tube Type K
0 to 12" water	up to 10 feet	1/4"	3/8"
" " " "	10 to 25 feet	1/2"	5/8"
" " " "	25 to 50 feet	3/4"	1"
12" water to 15 psi	up to 25 feet	1/4"	3/8"
" " " "	25 to 100 feet	1/2"	5/8"
15 to 50 psi	up to 50 feet	1/4"	3/8"
" " " "	over 200 feet	1/4" & 1/2" +	3/8" & 5/8" +
50 lbs. up	up to 200 feet	1/4"	3/8"
" " "	over 200 feet	1/4" & 1/2" +	3/8" & 5/8" +

+ use smaller line for first 50 feet nearest gauge and larger line for balance of length.
If pressures require it, use extra heavy pipe, of internal diameter similar to standard pipe in above table.

FIGURE 4. RECOMMENDED SIZES OF GAUGE CONNECTING LINES

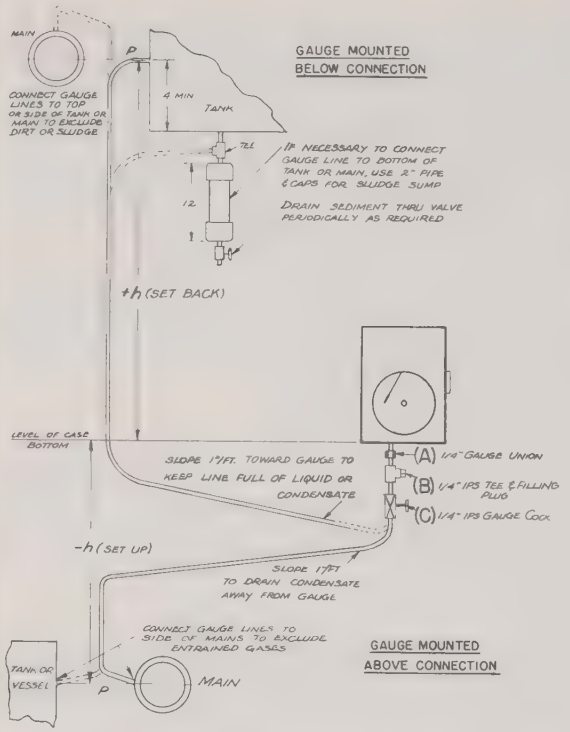

MAIN
P
GAUGE MOUNTED
BELOW CONNECTION
CONNECT GAUGE LINES TO TOP OR SIDE OF TANK OR MAIN TO EXCLUDE DIRT OR SLUDGE
4 MIN
TANK
TEE
IF NECESSARY TO CONNECT GAUGE LINE TO BOTTOM OF TANK OR MAIN, USE 2" PIPE & CAPS FOR SLUDGE SUMP
12
DRAIN SEDIMENT THRU VALVE PERIODICALLY AS REQUIRED
+h (SET BACK)
LEVEL OF CASE BOTTOM
SLOPE 1"/FT. TOWARD GAUGE TO KEEP LINE FULL OF LIQUID OR CONDENSATE
(A) 1/4" GAUGE UNION
(B) 1/4" IPS TEE & FILLING PLUG
(C) 1/4" IPS GAUGE COCK
-h (SET UP)
SLOPE 1"/FT TO DRAIN CONDENSATE AWAY FROM GAUGE
CONNECT GAUGE LINES TO SIDE OF MAINS TO EXCLUDE ENTRAINED GASES
TANK OR VESSEL
P
MAIN
GAUGE MOUNTED
ABOVE CONNECTION

FIGURE 5. INSTALLATION FOR NON-CORROSIVE LIQUIDS

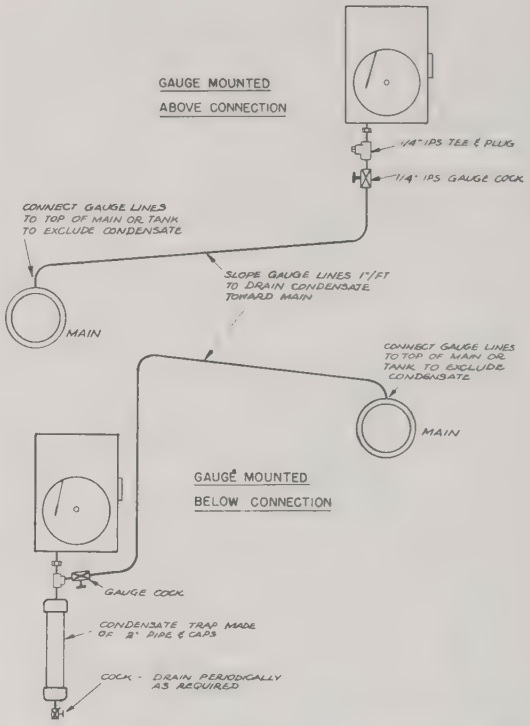

GAUGE MOUNTED
ABOVE CONNECTION
1/4" IPS TEE & PLUG
1/4" IPS GAUGE COCK
CONNECT GAUGE LINES TO TOP OF MAIN OR TANK TO EXCLUDE CONDENSATE
SLOPE GAUGE LINES 1"/FT TO DRAIN CONDENSATE TOWARD MAIN
MAIN
CONNECT GAUGE LINES TO TOP OF MAIN OR TANK TO EXCLUDE CONDENSATE
MAIN
GAUGE MOUNTED
BELOW CONNECTION
GAUGE COCK
CONDENSATE TRAP MADE OF 2" PIPE & CAPS
COCK - DRAIN PERIODICALLY AS REQUIRED

FIGURE 6. INSTALLATION FOR NON-CORROSIVE GASES AND AIR

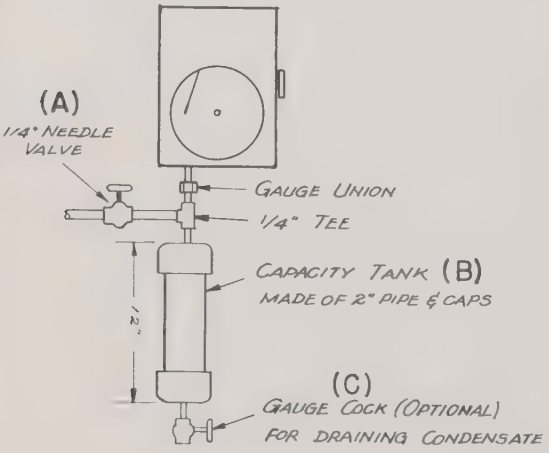


FIGURE 7. PULSATION DAMPER USING NEEDLE VALVE AND CAPACITY TANK (ALSO SERVES AS CONDENSATE OR SLUDGE TRAP).

FIGURE 8. ADJUSTABLE PULSATION DAMPER

4. Physical characteristics, such as correct viscosity, vapor pressure, freezing point, diffusion of the corrosive medium thru the sealing fluid, etc.

See Figure 9 for suggested sealing liquids. Some pressure media are so chemically active that no sealing liquid is wholly unattacked. Therefore, it is wise to periodically check the condition and level of the sealing liquid and replenish or replace it when necessary.

Parts List G6005 shows Bristol sealing chambers for a wide variety of conditions. Note that these liquid seals cannot be used on pressure ranges below 4 inches of water or on vacuum pressures below the vaporizing point of the sealing liquid used.

b. Capsule-type Seals. The Bristol Company can supply a capsule-type seal factory connected to and calibrated with the gauge it protects. It is a filled-system type of seal which cannot lose its filling fluid either in operation or during cleaning. It is self-compensating for ambient operating temperatures. See separate instructions covering these seals.

c. Purge Systems. Corrosive pressure media can be excluded from gauges by a purge system as in Figure 16. See paragraph 5b on page 8 for full discussion.

d. Corrosive-resistant Elements.

1. Stainless-steel helical elements made of Type 316 stainless-steel are available for certain ranges. These may be connected directly without a seal to all fluids to which Type 316 stainless-steel is corrosive resistant.

2. Lead-coated capsular elements. All capsular-type elements can be supplied with lead-tubing and with the interior of bellows and case connection electroplated with lead. Gauges so equipped can be directly connected without seals to pressure media which do not corrode lead, especially gases containing traces of sulphur dioxide, etc. Capsular elements can be electroplated to order, with silver, gold, nickel, etc., to make them impervious to a wide variety of corrosive media.

e. Ammonia Gauges. Stainless steel is not appreciably corroded by ammonia gas or liquid. Bristol can supply gauges with stainless steel elements, tubings and case connections which can be directly connected to ammonia without seals.

f. Mercury Amalgamation. Mercury amalgamates readily with copper, brass, silver solder, etc., and will rapidly cause failure of pressure elements containing such metals. Therefore, great care must be observed to prevent any accidental introduction of mercury or mercury vapors into any part of pressure gauges except those of all welded ferrous construction. Normally, the air entrapped in the pressure element and internal tubing will prevent any liquid from entering.

In installations of pressure pens in mercury-manometer flowmeters, the gauge lines must be so installed that the mercury which may be accidentally blown from the manometer cannot run down into the pressure gauge.

3. Viscous or Solidifying Fluids. Fluids which thicken or solidify on standing or cooling must be excluded from pressure gauges and connecting lines or kept in a continually fluid state.

a. Capsule-type Seal. Bristol capsule-type seals are especially useful for sealing such fluids because they may be easily disassembled for cleaning.

b. Heated Gauge Lines. If pressure medium is one that solidifies at ambient temperatures, it can sometimes be kept fluid by paralleling the gauge lines with a 1/4" steam or hot-water line and enclosing both lines in a single asbestos pipe insulation (see Figure 13). Where critical temperature characteristics of pressure medium make accurate temperature control necessary, steam or hot-water automatic regulating valves can be installed in the supply line to maintain any set temperature. Gauge lines can also be heated electrically as shown in Figure 14. A rheostat in the power supply will provide temperature regulation if necessary.

Some liquids which congeal on cooling can be excluded from gauge lines by air or hot-water purge. See paragraph 5b on page 8 for purge systems.

4. Freezing Ambient Temperatures. When gauges measuring freezable liquids or gases bearing condensable moisture must be mounted outdoors or in unheated places, both the measuring system and the exposed gauge line must be protected from freezing.

In mild climates where gauge is mounted above connection, sufficient protection is secured by using 1" pipe for gauge lines and heavy insulation. The large size pipe permits adequate convection counterflow. This method is especially useful for water mains, water towers and standpipes.

Additional protection for the pressure element can be obtained by installing a wire wound, ceramic insulated, heating resistor in the bottom of the gauge case. For a 120-volt line use a 50-watt 250-ohm resistor or a 25-watt 500-ohm resistor connected directly across the power terminals of the instrument or across the chart-drive terminals. Be sure to disconnect the resistor during warm weather to avoid over-heating the instrument. See also paragraph 3b above for methods of heating gauge lines.

Pressure Media	Suggested Sealing Liquids
Acetic Acid (to 50% soln.)	kerosene; mercury (very slow reaction)
Acetone	40% calcium chloride soln. (pH 8.5)
Alum solution	light, refined mineral oil
Ammonia	mercury; light, refined mineral oil
Benzol	40% calcium chloride soln.
Brine (sodium or calcium)	light, refined mineral oil perchlorethylene
Butane (gas) Propane (")	40% $CaCl_2$ solution
Butadiene	40% $CaCl_2$ soln.
Caustic Soda	refined mineral oil; kerosene
Chlorine	diaphragm seal - silver or tantalum, purging system
Creosote (wood preserving)	40% $CaCl_2$ soln.
Ethyl Acetate	40% $CaCl_2$ soln.; mercury
Fuel Oil	40% $CaCl_2$ soln.
	50/50 Prestone or glycerine and water
Hydrochloric Acid	silver diaphragm
	perchlorethylene (as one component of a double seal)
Lactic Acid 10%	kerosene
Menthol	40% $CaCl_2$ soln.
Milk of Lime	light, refined mineral oil
Molasses	light, refined mineral oil
Phenol	40% $CaCl_2$ soln.
Pitch or Tar	" " "
Phospheric Acid	Monsanto's HB-40 (for conc solns.)
	refined mineral oil (for dilute solns.)
Soda Ash	refined mineral oil
Sulphate liquor	refined mineral oil
Sulfuric Acid	refined mineral oil
Zinc Oxide Fumes	refined mineral oil; kerosene
Oleum Mixed Acids fuming Nitric Acid Hydrogen Fluoride	"Chlorpropane Liquid 170" mfd. by Hooker Electrochemical Company

FIGURE 9. SUGGESTED SEALING LIQUIDS FOR COMMON PRESSURE MEDIA

5. Pressure Media Containing Solids. Solids which can plug gauge lines must be excluded.

a. Sump. Where the pressure medium contains only small amounts of solid matter, a sump which is periodically drained, as required, will be sufficient protection (see Figure 5).

b. Purge Systems. Sticky, flocculent or excessive amounts of solid matter in pressure media can be excluded from gauge and gauge lines by a liquid or gas purge system (see Figure 16). Purge systems can be used only if the following considerations are not objectionable to the process involved.

1. Purge fluid must not combine in an objectionable way chemically or physically with the pressure medium.

2. Purge fluid must not dilute pressure medium to an objectionable degree.

3. In a purge system using a gas (such as air), venting of gas to atmosphere must be possible. Otherwise, the process will accumulate and finally be filled with the purging gas.

The common purging fluids are water and air. In general, water purging can be used only where pressure medium is a large quantity of flowing solution in which the dilution effect of purge water is negligible. Typical applications are numerous in such plants as pulp and paper or sewage disposal.

c. Installation and Operation of Purge System. (See Figure 16). The flow of purging fluid thru gauge lines will cause error due to pressure drop which will add to the gauge reading. This error may be held to a negligible minimum by observing the following:

1. Connect purge into gauge lines as close as possible to vessel or main being measured.

2. Use not less than 1/2" standard pipe between purge connection and vessel being measured. Use a gate valve to minimize pressure drop.

3. Pressure of purge supply must be not less than 200% of the maximum range to be measured (300% is better).

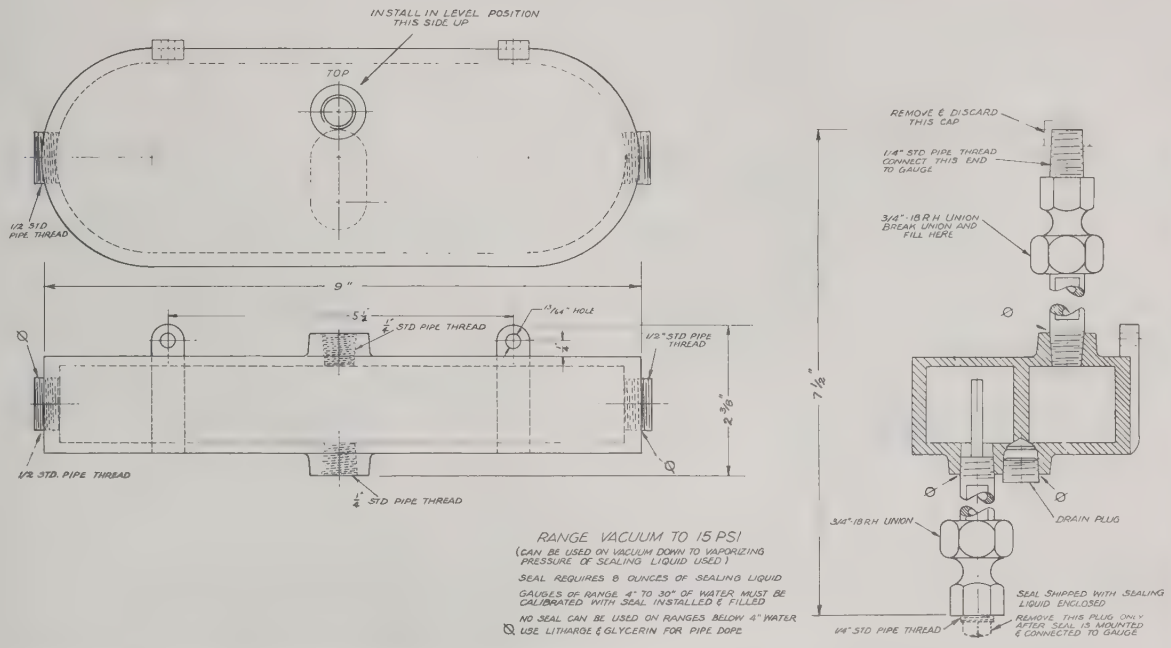

INSTALL IN LEVEL POSITION THIS SIDE UP
TOP
1/2 STD PIPE THREAD
9"
5 1/2"
1/2" STD PIPE THREAD
13/64" HOLE
1/2" STD PIPE THREAD
2 3/8"
1/2 STD. PIPE THREAD
1/4" STD PIPE THREAD
REMOVE & DISCARD THIS CAP
1/4" STD PIPE THREAD CONNECT THIS END TO GAUGE
3/4"-18 R.H UNION BREAK UNION AND FILL HERE
7 1/8"
3/4"-18 R.H UNION
DRAIN PLUG
SEAL SHIPPED WITH SEALING LIQUID ENCLOSED
REMOVE THIS PLUG ONLY AFTER SEAL IS MOUNTED & CONNECTED TO GAUGE
1/4" STD PIPE THREAD
RANGE VACUUM TO 15 PSI
(CAN BE USED ON VACUUM DOWN TO VAPORIZING PRESSURE OF SEALING LIQUID USED)
SEAL REQUIRES 8 OUNCES OF SEALING LIQUID
GAUGES OF RANGE 4" TO 30" OF WATER MUST BE CALIBRATED WITH SEAL INSTALLED & FILLED
NO SEAL CAN BE USED ON RANGES BELOW 4" WATER
USE LITHARGE & GLYCERIN FOR PIPE DOPE

FIGURE 10. FIXTURE 32 LOW PRESSURE SEALING CHAMBER FOR SEALING LIQUIDS HEAVIER THAN PRESSURE MEDIA

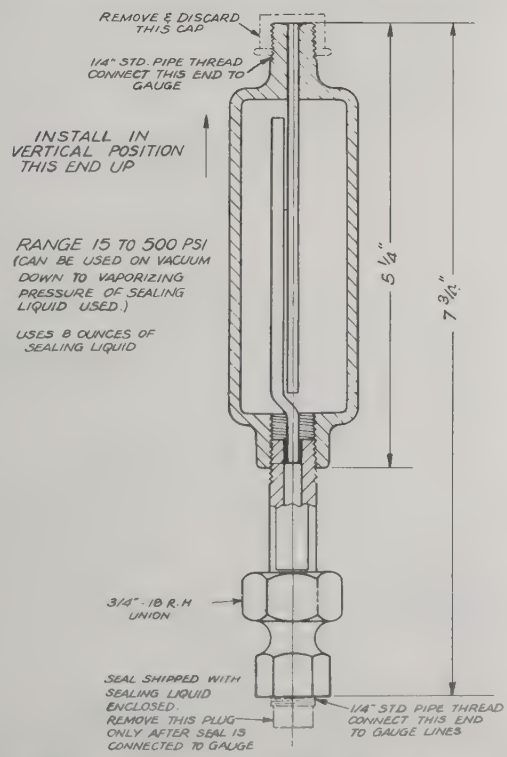

REMOVE & DISCARD THIS CAP
1/4" STD. PIPE THREAD CONNECT THIS END TO GAUGE
INSTALL IN VERTICAL POSITION THIS END UP
RANGE 15 TO 500 PSI
(CAN BE USED ON VACUUM DOWN TO VAPORIZING PRESSURE OF SEALING LIQUID USED.)
USES 8 OUNCES OF SEALING LIQUID
5 1/4"
7 3/16"
3/4"-18 R.H UNION
SEAL SHIPPED WITH SEALING LIQUID ENCLOSED. REMOVE THIS PLUG ONLY AFTER SEAL IS CONNECTED TO GAUGE
1/4" STD PIPE THREAD CONNECT THIS END TO GAUGE LINES

FIGURE 11. FIXTURE 33A HIGH PRESSURE SEALING CHAMBER FOR SEALING LIQUIDS HEAVIER THAN PRESSURE MEDIA

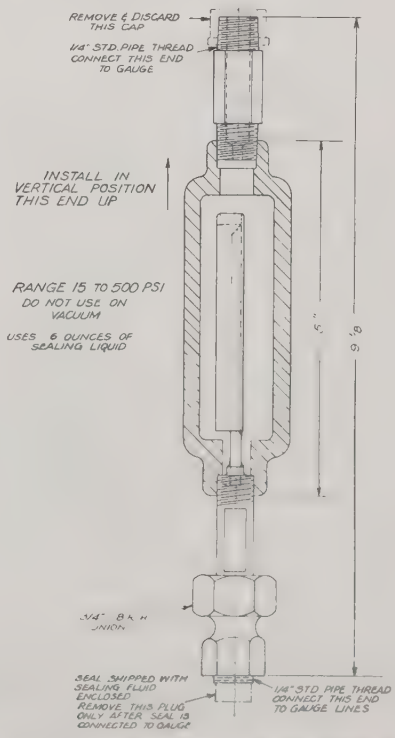

REMOVE & DISCARD THIS CAP
1/4" STD. PIPE THREAD CONNECT THIS END TO GAUGE
INSTALL IN VERTICAL POSITION THIS END UP
RANGE 15 TO 500 PSI
DO NOT USE ON VACUUM
USES 6 OUNCES OF SEALING LIQUID
5"
9 1/8"
1/4" B.R.H UNION
SEAL SHIPPED WITH SEALING FLUID ENCLOSED. REMOVE THIS PLUG ONLY AFTER SEAL IS CONNECTED TO GAUGE
1/4" STD PIPE THREAD CONNECT THIS END TO GAUGE LINES

FIGURE 12. FIXTURE 33B HIGH PRESSURE SEALING CHAMBER FOR SEALING LIQUIDS LIGHTER THAN PRESSURE MEDIA

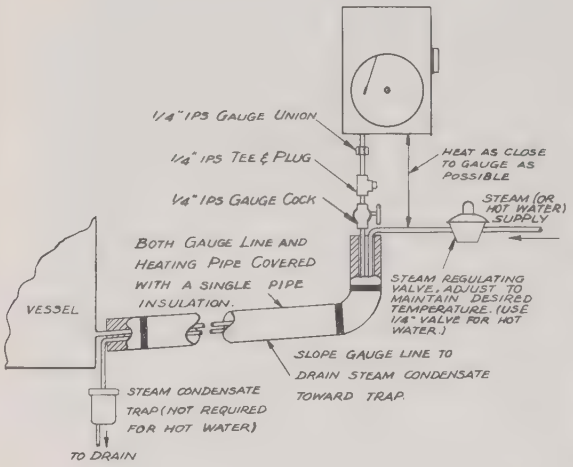

1/4" IPS GAUGE UNION
1/4" IPS TEE & PLUG
1/4" IPS GAUGE COCK
HEAT AS CLOSE TO GAUGE AS POSSIBLE
STEAM (OR HOT WATER) SUPPLY
BOTH GAUGE LINE AND HEATING PIPE COVERED WITH A SINGLE PIPE INSULATION.
STEAM REGULATING VALVE - ADJUST TO MAINTAIN DESIRED TEMPERATURE. (USE 1/4" VALVE FOR HOT WATER.)
VESSEL
SLOPE GAUGE LINE TO DRAIN STEAM CONDENSATE TOWARD TRAP.
STEAM CONDENSATE TRAP (NOT REQUIRED FOR HOT WATER)
TO DRAIN

FIGURE 13. STEAM HEATING GAUGE LINES TO PREVENT SOLIDIFYING OR FREEZING OF PRESSURE MEDIA

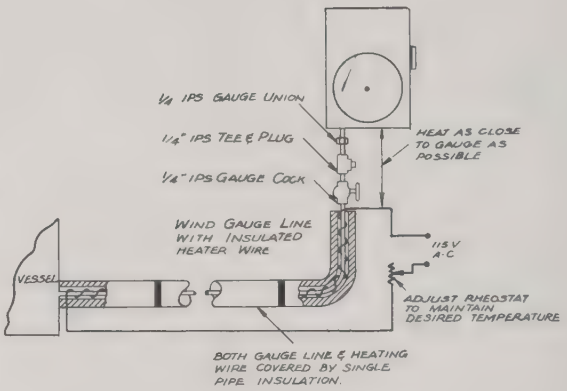

1/4 IPS GAUGE UNION
1/4" IPS TEE & PLUG
1/4" IPS GAUGE COCK
HEAT AS CLOSE TO GAUGE AS POSSIBLE
WIND GAUGE LINE WITH INSULATED HEATER WIRE
115 V A.C
VESSEL
ADJUST RHEOSTAT TO MAINTAIN DESIRED TEMPERATURE
BOTH GAUGE LINE & HEATING WIRE COVERED BY SINGLE PIPE INSULATION.

FIGURE 14. ELECTRIC HEATING GAUGE LINES TO PREVENT SOLIDIFYING OR FREEZING OF PRESSURE MEDIA

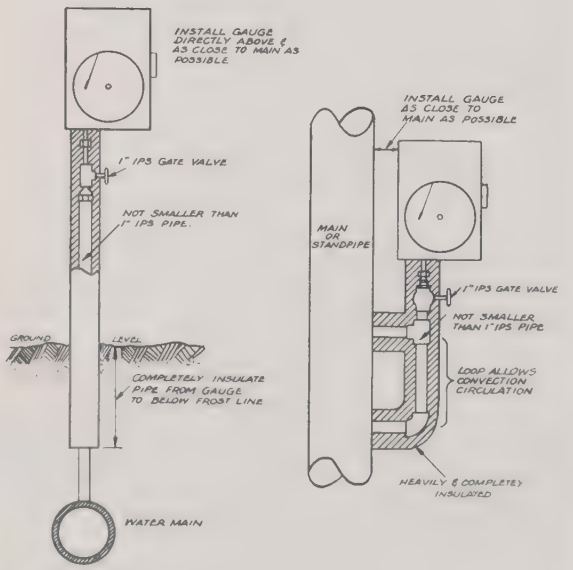

INSTALL GAUGE DIRECTLY ABOVE & AS CLOSE TO MAIN AS POSSIBLE
1" IPS GATE VALVE
NOT SMALLER THAN 1" IPS PIPE.
GROUND LEVEL
COMPLETELY INSULATE PIPE FROM GAUGE TO BELOW FROST LINE
WATER MAIN
INSTALL GAUGE AS CLOSE TO MAIN AS POSSIBLE
MAIN OR STANDPIPE
1" IPS GATE VALVE
NOT SMALLER THAN 1" IPS PIPE
LOOP ALLOWS CONVECTION CIRCULATION
HEAVILY & COMPLETELY INSULATED

FIGURE 15. PROTECTION FROM FREEZING BY CONVECTION AND INSULATION

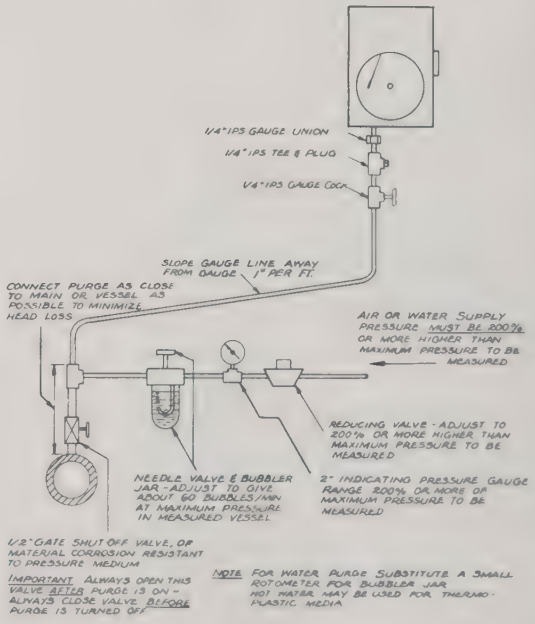

1/4" IPS GAUGE UNION
1/4" IPS TEE & PLUG
1/4" IPS GAUGE COCK
SLOPE GAUGE LINE AWAY FROM GAUGE 1" PER FT.
CONNECT PURGE AS CLOSE TO MAIN OR VESSEL AS POSSIBLE TO MINIMIZE HEAD LOSS
AIR OR WATER SUPPLY PRESSURE MUST BE 200% OR MORE HIGHER THAN MAXIMUM PRESSURE TO BE MEASURED
REDUCING VALVE - ADJUST TO 200% OR MORE HIGHER THAN MAXIMUM PRESSURE TO BE MEASURED
NEEDLE VALVE & BUBBLER JAR - ADJUST TO GIVE ABOUT 60 BUBBLES/MIN AT MAXIMUM PRESSURE IN MEASURED VESSEL
2" INDICATING PRESSURE GAUGE RANGE 200% OR MORE OF MAXIMUM PRESSURE TO BE MEASURED
1/2" GATE SHUT OFF VALVE, OF MATERIAL CORROSION RESISTANT TO PRESSURE MEDIUM
IMPORTANT ALWAYS OPEN THIS VALVE AFTER PURGE IS ON - ALWAYS CLOSE VALVE BEFORE PURGE IS TURNED OFF
NOTE FOR WATER PURGE SUBSTITUTE A SMALL ROTOMETER FOR BUBBLER JAR HOT WATER MAY BE USED FOR THERMO-PLASTIC MEDIA

FIGURE 16. AIR OR WATER PURGE SYSTEM FOR EXCLUDING PRESSURE MEDIA WHICH ARE CORROSIVE, SOLIDIFYING OR CONTAIN SOLID MATTER

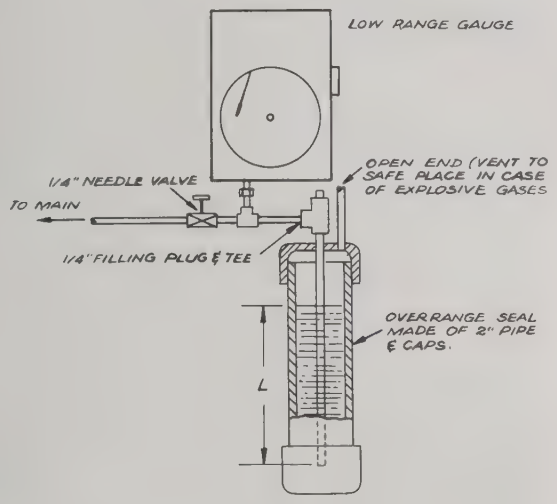

LOW RANGE GAUGE
1/4" NEEDLE VALVE
TO MAIN
OPEN END (VENT TO SAFE PLACE IN CASE OF EXPLOSIVE GASES
1/4" FILLING PLUG & TEE
OVERRANGE SEAL MADE OF 2" PIPE & CAPS.
L

FIGURE 17. LOW-RANGE GAUGE OVER-RANGE PROTECTION

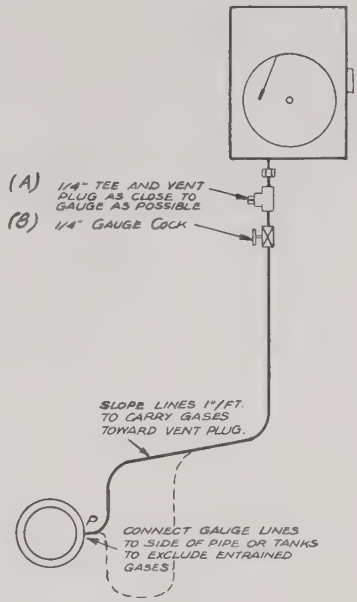

(A) 1/4" TEE AND VENT PLUG AS CLOSE TO GAUGE AS POSSIBLE
(B) 1/4" GAUGE COCK
SLOPE LINES 1"/FT. TO CARRY GASES TOWARD VENT PLUG.
CONNECT GAUGE LINES TO SIDE OF PIPE OR TANKS TO EXCLUDE ENTRAINED GASES

FIGURE 18. FILLING GAUGE LINES - GAUGE MOUNTED ABOVE CONNECTION

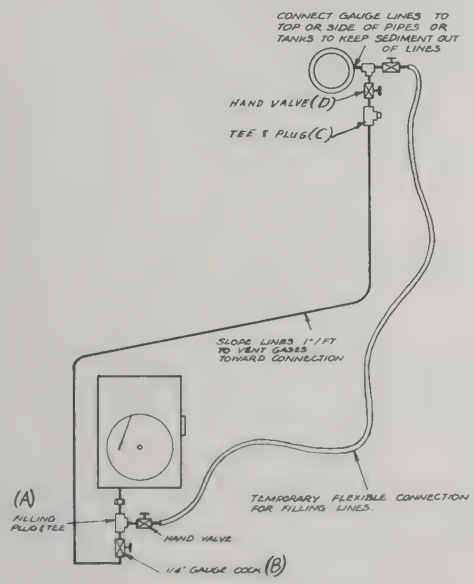

CONNECT GAUGE LINES TO TOP OR SIDE OF PIPES OR TANKS TO KEEP SEDIMENT OUT OF LINES
HAND VALVE (D)
TEE & PLUG (C)
SLOPE LINES 1"/FT TO VENT GASES TOWARD CONNECTION
(A)
FILLING PLUG & TEE
HAND VALVE
1/4" GAUGE COCK (B)
TEMPORARY FLEXIBLE CONNECTION FOR FILLING LINES.

FIGURE 19. FILLING GAUGE LINES - GAUGE MOUNTED BELOW CONNECTION

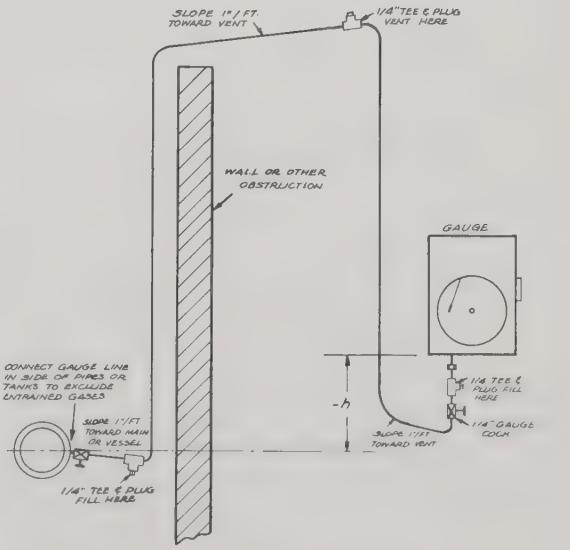

SLOPE 1"/FT. TOWARD VENT
1/4" TEE & PLUG VENT HERE
WALL OR OTHER OBSTRUCTION
GAUGE
CONNECT GAUGE LINE IN SIDE OF PIPES OR TANKS TO EXCLUDE ENTRAINED GASES
SLOPE 1"/FT TOWARD MAIN OR VESSEL
1/4" TEE & PLUG FILL HERE
-h
1/4" TEE & PLUG FILL HERE
1/4" GAUGE COCK
SLOPE 1"/FT TOWARD VENT

FIGURE 20. INSTALLATION AND FILLING WHERE GAUGE LINES GO OVER AN OBSTRUCTION

4. The reducing valve must be set to deliver not less than 200% of maximum range. The higher the pressure supplied to needle valve, the less the differential pressure change across it will be as the measured pressure changes, and the more uniform the flow of purge fluid will be. This will avoid excessive flow of purge fluid when the measured pressure is low.

5. Be sure to make adjustment of the purge flow rate when the pressure in the measured vessel is at its maximum. Adjust needle valve of air purge to give a low rate of bubbling (about 30 to 50 per minute). Adjust needle valve of liquid purge to give a flow of about 1 or 2 ounces per minute. **Caution:** Always turn on purge system before opening shut-off valve. Always close shut-off valve before turning off purge system supply.

6. Mechanical Protection of Pressure Element. There are definite limits to the mechanical deflection which pressure elements can withstand without being permanently deformed, resulting in loss of calibration. To prevent such over deflection under various conditions of use, Bristol uses two factory methods of protecting its gauges.

a. Element Stop. Mechanical stops are built into gauges which stop the pressure element at either or both the high or low pressure end of its travel.

b. Spring Link. A pen linkage stop (item 13, Figure 1) is provided which stops the pen or pointer travel at either edge of chart, but by means of a spring link (item 9) the pressure element can continue to move. This protects only the pen and linkage. The element must be strong enough to withstand the over or under travel.

7. Corrections for Level. If it is desired to have low-range gauges and gauges measuring liquid-level pressures read accurately the pressures above or below the level at which the gauge is mounted, correction must be made to the gauge to compensate for plus or minus head of liquid in vertical portions of gauge lines. This point of measurement (zero line, datum line or reference level) is usually the level at which gauge line connects to vessel or main but can be any level desired, such as the bottom of a tank or pond.

a. Gauge Mounted Below Point of Measurement. (See Figure 5). The pressure head due to the column of liquid (+h) will add to the pressure at point of measurement (P), and the gauge will read the sum of the two pressures. To correct gauge to read only the pressure at point P, the gauge reading must be reduced or "set-back" by an amount equal to the head of liquid (+h) due to the difference in level between gauge and point P. Bristol gauges may be ordered with "set back" adjustment factory made. Such gauges include necessary element protection. All factory corrections for level are measured to the bottom of the gauge case, and factory-corrected gauges should be mounted referring to this point of the case.

b. Gauge Mounted Above Point of Measurement. (See Figure 5). The pressure head due to column of liquid (-h) will subtract from pressure at point of measurement P, and gauge will read the difference of the two pressures. To correct the gauge to read only the pressure at P, the gauge reading must be increased or "set up" by an amount equal to the head of liquid (-h) due to the difference in level between the bottom of gauge and point P. Bristol gauges may be ordered with "set up" adjustment factory made. Such gauges include necessary element protection. All factory corrections for level are measured to the bottom of the gauge case, and factory-corrected gauges should be mounted referring to this point of the case.

c. How to Make Level Corrections in the Field. The maximum amount of set back or set up which may be applied in the field to standard elements varies widely with the type and range of the element. It is advisable to first check with The Bristol Company Factory at Waterbury, giving the model and serial numbers of instrument, to find out if your pressure element is suitable for use on a set-back or set-up range.

The two prescribed methods of making level corrections in the field are as follows:

1. After gauge and gauge lines are completely installed, install and adjust link (9) and stop (13) and lever (14) so as to stop pen travel just off the upper or lower end of chart or scale. Be sure that gauge lines are completely filled with pressure medium (see paragraph 10 on page 13). Create a known pressure (preferably zero i.e., atmospheric) at point of measurement P (see Figure 5). Adjust pen or pointer to read exactly the pressure at P by means of micro adjuster (15). The gauge now reads only the pressure at point P.

2. If the pressure at point P cannot be brought to a known or steady value, the following alternate method can be followed.

Accurately measure the difference in levels between point P and the bottom of the gauge case. **Note:** When a liquid seal is used, measure $\pm h$ from the center line of the seal instead of the bottom of the gauge case.

When gauge reads a pressure near mid-scale, turn off gauge cock. This holds pressure reading steady. Make set-up or set-back correction on chart in pounds per square inch from following formula:

$$\text{Set up or set back (psi)} = \frac{\pm h \times \text{sp. gr.}}{2.3097}$$

where $\pm h$ = difference in levels in feet

sp. gr. = specific gravity of pressure medium corrected for temperature if necessary

If micro adjuster (15) does not permit sufficient adjustment, loosen screws (16) and shift lever (5) until pen reads correct value.

Retighten screws (16) firmly. Use micro adjuster (15) only for fine adjustments. It is always wise to check calibration of gauge after making level corrections. **Caution:** Be sure gauge lines are completely filled with liquid before making any level corrections.

8. Overrange Protection. Pressure gauges must never be subjected to pressures above their scale range unless they have been protected from damage. Even momentary overpressures may permanently deform element or linkage, destroying calibration.

Bristol gauges can be ordered with overrange protection built into them. If, after gauge is purchased, it is found necessary to have overrange protection, a link (9), stop bracket (13) and stop lever (14) can be added.

a. Low-range Gas Gauge. A simple overrange protection for air and gas gauges, which can be easily built and installed in the field, is shown in Figure 17. The height of sealing liquid "L" above the bottom end of bubble pipe should be about 10% greater than the equivalent head in sealing liquid equal to the maximum range of the gauge, according to the following formula:

$$L \text{ (inches)} = \frac{1.1 \times \text{gauge range ("wtr.)}}{\text{sp. gr. of seal liquid}}$$

Correct the specific gravity of sealing liquid for temperature if necessary. A sealing fluid which will not evaporate, freeze or be contaminated by gas should be used. Do not use a viscous liquid because the pressure element may be damaged before bubbles can escape thru the thick liquid.

After the gauge and overpressure seal are installed, close needle valve and pour sufficient sealing liquid thru filling plug to produce the correct "L".

In operation the needle valve should be opened just enough to give satisfactory speed of response to normal pressure changes.

9. Partial Ranges. A partial-range gauge is one having no zero in its scale or chart. Example: 50 to 100 psi (also known as suppressed zero gauge). Only the desirable or useful portion of the range is recorded or indicated. In partial-range gauges, protection must be provided to prevent damage to the element or linkage thru the suppressed part of the total range. Bristol gauges can be ordered factory built for partial ranges.

10. Filling Gauge Lines. It is essential that gauge lines of all gauges measuring liquid pressures and all gauges mounted below connection measuring pressures of gases with condensable vapors be completely filled with the liquid pressure medium. Entrapped air at any point of gauge lines may cause serious errors in pressure reading.

a. Gauge Mounted Below Connection. (See Figure 19.) Install tee, filling plug "A" and cock "B" as close as possible to the gauge. Install tee, plug "C" and valve "D" as close as possible to connection.

Close valve D. Remove plug C. Remove plug A and connect in its place a temporary supply of the liquid pressure medium under pressure. A flexible hose is suggested for this purpose.

With valve B open, permit the liquid pressure medium to flow into the line. While the liquid is filling the line, tap the line lightly with a hammer to jar loose air bubbles. When the liquid flows out of tee C completely free from bubbles, close valve B. Disconnect the temporary hose and replace plugs A and C. Open valves D and B wide. Make set-back correction per paragraph 7c on page 12.

b. Gauge Mounted Above Connection. (See Figure 18.) Install tee and plug A and gauge cock B as close as possible to the gauge. Close cock B and remove plug A. With pressure on, open cock B slightly and allow all air and gases to escape. Permit liquid to flow while rapping gauge lines until flow is completely free of bubbles. Shut cock B and replace plug A. Open cock B wide. Make set-up correction as directed in paragraph 7c on page 12.

Repeat venting procedure periodically to vent accumulated air or gases.

In general, it is best to fill gauge lines from the lowest point and vent them from the highest point (see Figure 20). Therefore, a tee and plug should be installed at the lowest and highest point together with the necessary shut-off valves. Also, it is best that all horizontal portions of gauge lines slope upward toward the nearest vent. Then, as filling liquid rises from the lowest point, it will push gases ahead of it. To attempt to fill lines from the top will very likely result in entrapped air and consequent error.

It might be supposed that, when a gauge measuring liquid pressure is mounted above connection, gases entrapped in gauge line would adequately transmit the pressure to the pressure element. However, such unfilled gauge lines would produce error for two reasons:

As pressure at P (Figure 18) varied, liquid pressure medium would rise and fall in line, causing a variable head and variable error in gauge reading.

Gases in an unfilled gauge line are more or less absorbed by pressure medium which will then rise more or less in gauge lines, causing an unpredictable and ever changing error in gauge reading.

11. Gauges Measuring Gas and Air. When gauge lines of such gauges are installed, draining and venting of condensate must be provided. Figure 6 shows necessary details and is self-explanatory.

12. Gauges Measuring Liquids. When gauge lines of liquid gauges are installed, provisions for filling or draining lines must be provided as shown in Figures 5, 18 and 19.

13. Gauges Measuring Steam or Hot Condensable Vapors. The temperature of fluids entering pressure gauges must never exceed 150°F (65°C).

a. Gauge Mounted Below Connection. When a steam gauge is mounted below connection (see Figure 21), it will automatically be protected from high temperatures by formation of condensate in gauge lines. It is only necessary that gauge lines be sloped to vent air or gases and that corrections for level be made (see paragraph 7 on page 12). It is wise to initially fill gauge lines with water to prevent possible over-heating of pressure element before condensate has time to form.

b. Gauge Mounted Above Connection. (See Figure 21.) When a steam gauge is mounted above connection, a coil pipe seal (Figure 22) **must be** installed in the gauge line near the gauge. Before steam is turned on, pour enough water thru filling plug with lever cock open to be sure coil pipe is full. Steam condensate thereafter keeps coil filled. Gauge lines must not be smaller than 1/2" standard pipe size to provide free counterflow of steam and condensate. Avoid having low points in gauge lines which would trap condensate and cause errors.

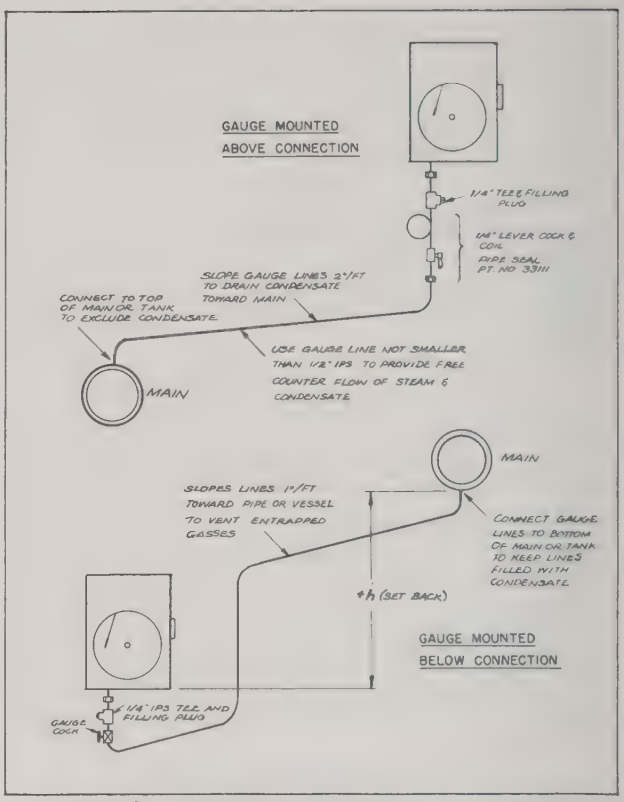

GAUGE MOUNTED ABOVE CONNECTION
1/4" TEE & FILLING PLUG
1/4" LEVER COCK & COIL PIPE SEAL PT. NO 33111
SLOPE GAUGE LINES 2"/FT TO DRAIN CONDENSATE TOWARD MAIN
CONNECT TO TOP OF MAIN OR TANK TO EXCLUDE CONDENSATE.
USE GAUGE LINE NOT SMALLER THAN 1/2" IPS TO PROVIDE FREE COUNTER FLOW OF STEAM & CONDENSATE
MAIN
MAIN
SLOPES LINES 1"/FT TOWARD PIPE OR VESSEL TO VENT ENTRAPPED GASSES
CONNECT GAUGE LINES TO BOTTOM OF MAIN OR TANK TO KEEP LINES FILLED WITH CONDENSATE.
+h (SET BACK)
GAUGE MOUNTED BELOW CONNECTION
1/4" IPS TEE AND FILLING PLUG
GAUGE COCK

FIGURE 21. GAUGE INSTALLATION FOR STEAM OR HOT CONDENSABLE VAPORS

1/4" IPS THREAD CONNECT TO GAUGE
BREAK GAUGE UNION & THIS UNION TO REMOVE SEAL FOR FILLING & CLEANING.
1/4" IPS THREAD CONNECT TO GAUGE LINE.

FIGURE 22. FIXTURE 25 COIL PIPE STEAM SEAL

14. Compound Pressure and Vacuum Gauges. Bristol gauges can be supplied to measure both vacuum and pressure ranges on a single chart or scale. Example: 30 inches of mercury vacuum thru 0 to 15 pounds per square inch pressure. Great care must be taken to prevent corrosive or solidifying pressure media from being drawn into gauge lines and element when vacuum is released and pressure applied. Bristol liquid sealing chambers, Figure 11, (sealing liquid heavier than pressure medium) can be used with certain pressure media. Refer such applications to the Bristol Field Engineer nearest you.

15. Explosive or Inflammable Pressure Media. With such pressure media, use only all steel pipes, valves, fittings, sealing chambers, etc., in gauge lines. If a fire occurs at any point along gauge lines, the all-steel construction will resist melting, preventing the explosive or inflammable pressure medium from being added to the fire.

16. Case Purging in Explosive or Corrosive Atmospheres. A pressure gauge containing any electrical circuits (chart drives, electric control, alarm, etc.) should be air purged if its ambient atmosphere may at any time contain over the lower explosive limit of explosive substances. Likewise, any gauge mounted in corrosive atmosphere should be internally protected by case purging.

Air purging consists of providing a constant supply of clean, low pressure air to the instrument case, which keeps it at an internal pressure slightly above the surrounding atmosphere, thereby preventing explosive or corrosive substances from entering.

Purge connections can be made by 1/2" standard pipe screwed into any unused position of gauge case connection plate. A reducing valve and needle valve should be used and adjusted to produce a very small flow of air. **Caution:** Be sure to drill a 1/16" hole in bottom of case to prevent build up of excessive internal pressures. On low-range gauges, be certain that internal pressures are not so high as to cause error in gauge reading.

17. Ambient-pressure Effects on Low-range Gauges. All elastic member pressure gauges measure the difference between atmospheric and internal pressures. On low-range gauges, changes in ambient atmospheric pressure may cause serious errors. Caution must be used in installing low-range gauges in rooms ventilated by exhaust or circulating fans, air-conditioned rooms, etc. Even wind pressures on open doors or windows may cause serious errors.

Opening and closing case doors of low-range gauges will cause a momentary variation in reading, especially apparent in recording gauges.

PART III SERVICE

Note: This instruction covers service to the measuring system only. See separate instructions for service to chart drive, recording, controlling system, etc.

A. Checking and Calibrating Pressure Gauges

There are three methods of checking the accuracy of pressure gauges. If the gauge cock, pipe tee and plug recommended in paragraph 3 on page 3 have been installed, a complete check and calibration can be quickly performed without shutting off the process to which the gauge is connected or without dismounting the gauge.

Caution: Be sure gauges are exactly level before checking or calibrating.

Do not overlook corrections for level (set up or set back) which may have been made to gauge (see paragraph 7 on page 12).

Be sure to run capsular-element pressure gauges up and down scale several times before checking or calibrating.

In checking or calibrating recorders, make adjustments based on actual pen tracings quickly obtained by loosening chart hub and slightly turning chart by hand.

1. Zero Check. Close gauge cock C and remove pipe plug B (see Figure 5). This subjects gauge to zero (atmospheric) pressure. If no gauge cock or plug is provided, shut off the pressure medium and uncouple gauge union A. Pen or pointer should read exactly zero. If it does not, correct by turning micro adjustment on pen arm. A zero check assures that the gauge reads correctly at one point only - zero. Usually, the calibration shift of a gauge will be constant thruout its range, and a zero adjustment will correct this shift.

Note: A zero check of 8" and 12" dial-type indicating gauges cannot be made because a movement stop stops the pointer at the first scale division above true zero. For these instruments make a point check and adjustment at some higher pressure.

2. Comparison with Test Gauge. A check and calibration of the entire range can be made without dismounting the gauge by connecting a large size (6-inch diameter or larger) test gauge with better than 1% accuracy into a tee in the gauge line as close as possible to the instrument. Readings are compared at several points of the range, using the pressure medium as the source of test pressure. This type of test assures gauge accuracy thru its whole range.

3. Laboratory Calibration. Most accurate calibration is done by removing the gauge to the instrument laboratory and calibrating against a primary standard, such as a dead weight gauge tester or a liquid column manometer.

4. How to Calibrate Bristol Gauges.

a. Mechanical Alignment. This adjustment places all links and levers in correct geometrical relation so as to minimize angularity errors. This step should be necessary only when the length of link (9) or adjustments of lever (12) or friction disk (4) have been disturbed.

Helical Elements. (Figure 1) Loosen screws (16) and two link screws (8). Center zero adjuster (15). Apply exactly 1/2 of full-scale pressure to gauge and hold it there. While manually holding pen or pointer at half scale, adjust length of link (9) so that the imaginary line "A-A" connecting element shaft and link bearing (9) is parallel to lever (12). While holding this parallelism, firmly tighten two screws (8) and screws (16).

Proceed with span adjustment paragraph b below.

Capsular Elements. (Figure 2) Loosen screws (16) and two link screws (8). Center zero adjuster (15). Apply exactly 1/2 of full-scale pressure to the gauge and hold it there. While manually holding pen or pointer at 1/2 scale, adjust length of link (9) so that imaginary line "B-B" is parallel to lever (12). While holding this parallelism, firmly tighten two screws (8) and screws (16). Next, proceed with span adjustment below.

b. Span Adjustment. If gauge reads correctly at zero but is erroneous at the upper points of the range, a span adjustment must be made (also called range, scale length adjustment).

Screwing knurled nut (7) back or forth changes the effective length of threaded lever. Increasing lever length increases span thru which pen travels for a given pressure change. Decreasing effective length of lever decreases span thru which pen travels for a given pressure change.

Proceed as follows: (refer to Figure 1 or 2).

1st. Perform zero check carefully.

2nd. Check pen or pointer reading at a pressure equivalent to 80-90% of full scale.

3rd. Loosen lock screw (6). If pen reads high, slightly turn knurled span adjustment nut (7) toward bearing end of threaded lever. If pen reads low, slightly turn nut (7) toward outer end of threaded lever.

4th. Recheck zero and readjust pen if necessary.

5th. Recheck reading at a pressure equivalent to 80-90% of full scale.

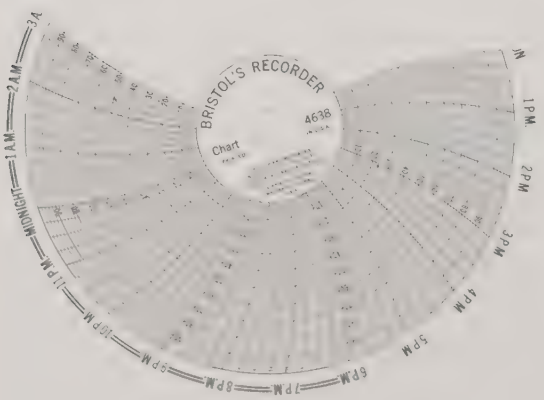


FIGURE 23. CUTAWAY CHART FOR USE IN CALIBRATION

6th. Repeat span adjustments to nut (7), being sure to repeat zero adjustment each time the span adjustment is changed.

7th. When gauge has been adjusted to read correctly at both zero and working pressure, retighten lock screw (6) firmly.

Note: On controlling gauges with either electric or air control, the controller set-point indexes must always be adjusted after pen or pointer adjustment is changed. For details of calibration of set-point indexes, see separate instructions furnished covering the controller system.

To avoid inconvenience of repeated removal and replacement of the recording chart and chart plate between each test reading, prepare a cutaway chart from the gauge being calibrated as per Figure 23. Paste cutaway chart on stiff cardboard for support. During calibration remove chart plate and use this cutaway chart held by chart hub.

c. Linearity Adjustment. If gauge reads correctly at zero and at the top of the scale but is erroneous at midscale, a linearity adjustment is required. The linearity adjustment is the adjustable link, item 9, Fig. 1 or 2.

If lever arm (5) pushes on link (9) for increasing values of pressure, lengthen link (9) to increase motion in the top portion of scale or shorten link (9) to decrease motion in the top portion of scale.

If lever arm (5) pulls on link (9) for increasing values of pressure, shorten link (9) to increase motion in the top portion of the scale or lengthen link (9) to decrease motion in the top portion of scale.

Next repeat span and zero adjustments until proper calibration is obtained. The zero adjustment should always be the last adjustment made.

5. Test Gauge Manifold. For large users of gauges, it is recommended that a test gauge manifold as per Figure 24 be made and kept for comparison checking and calibrating. For low ranges, substitute a portable water or mercury manometer in place of the indicating gauge.

To use manifold, first shut off gauge cock A, remove plug C and screw in test manifold. With valve A shut and valve B open, perform zero check and adjustment. Check calibration by comparing the two gauges at working pressure. Any pressure between zero and maximum attained by the pressure medium can be obtained by manipulation of the two valves A and B. If tested gauge is in error, calibrate as per paragraph 4 on page 15.

Note: If the pressure medium is too low or too unsteady in pressure to act as a satisfactory source of test pressure, an auxiliary source of test pressure (water or air) can be connected thru a second needle valve in place of plug D. Valve A will then be shut off until test is complete.

If pressure medium is a liquid, provide a bucket to catch drip from valve B.

B. Replaceable Pressure Elements

All Bristol pressure gauges are made so that the entire pressure measuring system can be exchanged or replaced in the field without disturbing its calibration. New, factory-calibrated elements can be ordered at any time. Factory-made replacement elements are calibrated and tested in a standard recording gauge and then removed without disturbing calibration, packed and shipped ready for installation in the field.

1. Changing Ranges. An important feature of Bristol gauges is that pressure elements of any range can be interchanged between gauges of the same size (i.e., 8" or 12" size), whether recorder or controller. It is also possible to convert a recording gauge to a thermometer by installing a complete temperature system. No case drilling and only a screwdriver is required.

2. Standby Pressure Elements. Users having several Bristol gauges will do well to stock one or two calibrated pressure elements of each range used for quick replacement.

3. How to Remove Pressure Elements. Refer to Figures 1 & 2. Elements to be exchanged, replaced or repaired should be removed as follows: Uncouple case connection from split connection plate. (See Instructions Y19800 on Series 500 case.) Disconnect lower end of link (9) from span adjuster (7) by lifting and swinging aside tab. **Do not** loosen screws (8) or disconnect top bearing of link (9) from lever (12). Unscrew two screws (3) and remove element, mounting and tubing as one unit.

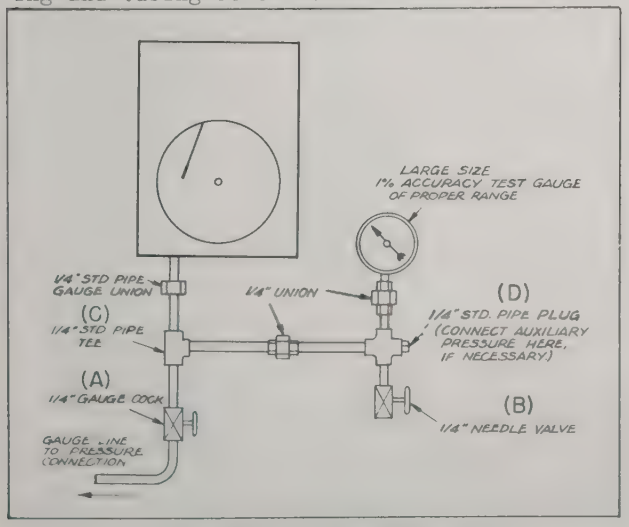


FIGURE 24. TEXT GAUGE MANIFOLD

Note: There are several bearing holes in pen shaft lever (12). All holes but one are painted black. Your gauge was calibrated using unpainted hole.

4. How to Install Replacement Elements. Carefully unpack replacement element. **Do not** disturb any of its adjustments. Install element in gauge case by means of two screws (3) and using the mounting holes specified on the tag attached to the replacement element. Install case connection in split connection plate (either back or bottom connected), bending tubing as required. Be careful not to strain connection to element. Connect lower end of link (9) to span adjuster (7). Be sure the upper end of link (9) is connected to the unpainted hole in pen shaft lever (12). Do not loosen link screws (8) or lock screw (6).

Check and adjust zero. If link (9) and span adjuster (7) have not been disturbed, the gauge will usually be in calibration. However, it is always best to check the calibration and adjust it necessary.

5. How to Order Replacement Pressure Elements. Order from nearest Bristol Branch Office, giving model, serial and chart numbers of your gauge as listed on the instrument name plate. If ordering a range different from your existing gauge, be sure to give the new range and new chart number desired.

C. Lubrication and Cleaning

Never lubricate any bearing in a pressure measuring system. If bearings become gummy or dirty, clean with carbon tetrachloride applied with a small soft brush. If bearings are badly corroded, clean gently with crocus cloth. **Never** use a file or emery cloth.

For lubrication of chart drives, see instructions covering the recording system.

D. Factory Repair of Gauges

Unless you have facilities for gauge calibration, it is best to return the whole instrument to a Bristol Branch or Main Factory for repair. If you have calibrating facilities, only the pressure measuring system need be returned for repair.

E. Repairs, Correspondence and Shipping

Send all parts and gauges for repair or exchange only to Bristol Branch or Main Factories, not to Branch Offices.

Send all correspondence and orders to the nearest Branch Office.

Be sure to state model and serial numbers in all orders, correspondence and shipments.

Identify your shipments fully, including exact return address, your order number, etc.

See last page of instruction book for list of addresses of Bristol Field Organization.

The Bristol Company
Waterbury 20, Connecticut Printed in U.S.A.

PRESSURE AND VACUUM GAUGE ACCESSORIES

UNIONS

PART NUMBER	SIZE	KIND OF METAL	REMARKS
3855	1/4"	Brass	This union is offered for standard gauges
22546	1/4"	Steel	
.....	1/4"	Monel	Not available in lots less than a dozen
83590	1/4"	S.S.	

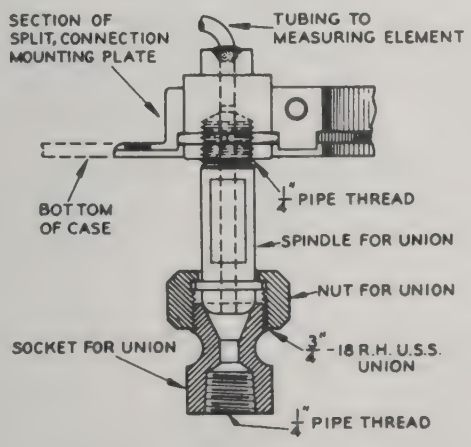
Combination of parts: 3987 (socket), 43520 (nut) and 13976 (corrugated nipple), for low pressure portable gauges, over end of which 3/8" rubber hose may be slipped.

SOCKETS

I.P.S.	MATERIAL	PART NO.
Internal Threads to fit 1/4 in unions		
1/4"	Brass	3987
1/4"	Steel	23810
1/4"	Stainless Steel	83591

I.P.S.	MATERIAL	PART NO.
External Threads to fit 1/4 in union		
1/4"	Brass	6829
1/4"	Steel	23174
1/2"	Steel, 2000 to 4000 lb Press	42390

UNION CONNECTION FOR SERIES 500 CASES



SPINDLES FOR UNIONS

MATERIAL	PART NO.
Brass, standard for 1/4 in I.P.S.	3986
Steel	23176
Stainless Steel	83592

NUTS FOR UNIONS

MATERIAL	PART NO.
Brass	43520
Steel	23175
Stainless Steel	83593

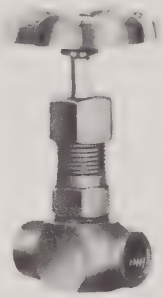
Split connection mounting plate assembly, for series 500 cases, consisting of: (all black finish No. 114)

Blank plate ..... Part 82653
Top half of split plate ..... Part 82674
Bottom half of split plate ..... Part 83998

Part 83998 can be identified by the two threaded holes for mounting screws. The two holes in the companion part 82674 are for clearance of mounting screws only and are not threaded.

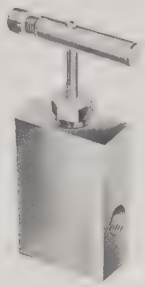
PRESSURE AND VACUUM GAUGE ACCESSORIES -- (Continued)

Brass Body-Brass Stem 1/4" Thread
Pressures 0-399
Part No. 7297



Steel Body. Stainless Steel Stem.1/4" Thread
Pressure 400-1999 psi
Part No. 48280

Steel Body. Monel Stem. 1/2" Thread.
Pressures 2000 - 5000 psi
Part No. 48281



Stainless Steel (303) Body 3/8" pipe thread machined in body
Pressures to 30,000 psi
Part 90478

MARTIN DECKER PULSATION DAMPER

A – GAUGE
B – INLET
C – ADJUSTING

For Pressures up to 12,000 psi
Part No. 49242
Part No. 83459
Part No. 83458

NEEDLE VALVES AND PULSATION DAMPERS
For Throttling Rapidly Fluctuating Pressures. See Catalog.

NEEDLE VALVES

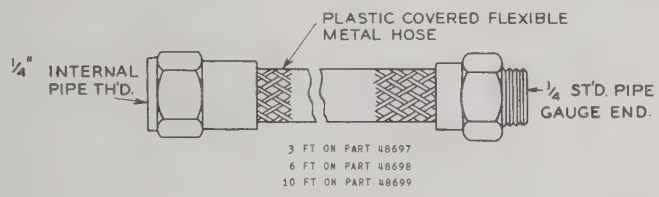
PART NUMBER	PRESSURE	BODY	STEM	STD. PIPE THREAD
77406	0-399 psi	Brass (Angle Type)	Brass	1/8"
7297	0-399 psi	Brass	Brass	1/4"
48280	400-1999 psi	Steel	Stainless Steel	1/4"
48281	2000-5000 psi	Steel	Stainless Steel	1/2"
90478	to 30,000 psi	St. Steel (303)	Stainless Steel (347)	3/8"

MARTIN DECKER PULSATION DAMPER "UTILITY" DAMPER

PART NUMBER	PRESSURE	BODY	STEM	STD. PIPE THREAD	DIMENSIONS
49242	0-3000 lb	Brass	Stainless Steel	1/4"	4" Overall x 1-1/2" O.D.
83459	0-5000 lb	Stainless Steel	Stainless Steel	1/4"	4" Overall x 1-1/4" O.D.
83458	0-12000 lb	Stainless Steel	Stainless Steel	1/4"	4" Overall x 1-3/4" O.D.

FLEXIBLE CONNECTIONS FOR BRISTOL'S PRESSURE GAUGES

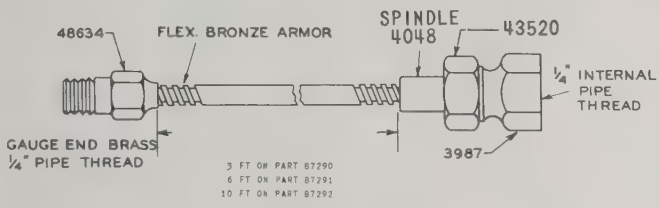
The following connections will fit equally well on all series 500 Gauges and on Model 40M. These connections are also suitable for any Model 22M now in service with addition of Union part 3855 listed below.


PLASTIC COVERED FLEXIBLE METAL HOSE
¼" INTERNAL PIPE TH'D.
¼ ST'D. PIPE GAUGE END.
3 FT ON PART 48697
6 FT ON PART 48698
10 FT ON PART 48699

2 INCHES WATERS TO 10 PSI

Supersedes old fixtures 209 & 210

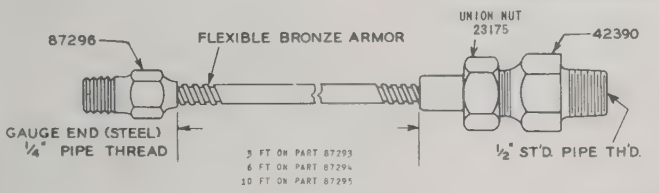
PART NUMBER	DESCRIPTION
	2 INCHES WATER TO 10 PSI
48697	3 feet Metal Hose
48698	6 feet Metal Hose
48699	10 feet Metal Hose



10 PSI TO 1999 PSI

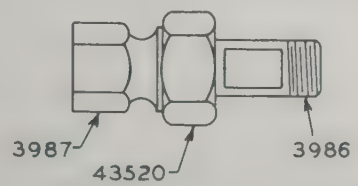
Supersedes old fixtures 208 & 213

	10 PSI TO 1999 PSI
87290	3 ft. Bronze Armored Conn. Tbg.
87291	6 ft. Bronze Armored Conn. Tbg.
87292	10 ft. Bronze Armored Conn. Tbg.



Supersedes old fixtures 179G & 211

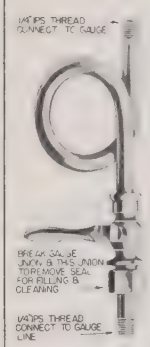
	2000 PSI AND HIGHER
87293	3 ft. Bronze Armored Conn. Tbg.
87294	6 ft. Bronze Armored Conn. Tbg.
87295	10 ft. Bronze Armored Conn. Tbg.



UNION PART 3855 (Brass) for Model 22M

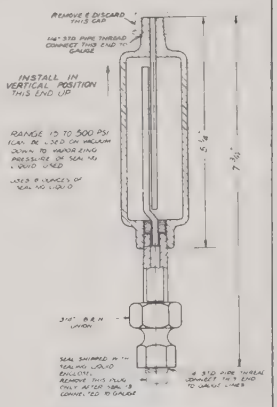
SEALS

For the protection of pressure elements

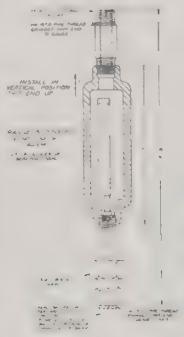

1/4 IPS. THREAD CONNECT TO GAUGE
BREAK GAUGE UNION @ THIS UNION TO REMOVE SEAL FOR FILLING & CLEANING
1/4 IPS. THREAD CONNECT TO GAUGE LINE

Coil Pipe Syphon or Pigtail Fixture No. 25, used as protection from steam. When ordering specify lever cock if wanted with syphon.

FIXTURE 25 - TYPE E SEAL


REMOVE & DISCARD THIS CAP
1/4" STD PIPE THREAD CONNECT THIS END TO GAUGE
INSTALL IN VERTICAL POSITION THIS END UP
RANGE 15 TO 500 PSI. CAN BE USED ON VACUUM DOWN TO VAPORIZING PRESSURE OF SEALING LIQUID USED
USES 8 OUNCES OF SEALING LIQUID
5 1/4"
7 3/4"
3/4" B.S.M. UNION
SEAL SHIPPED IN THE SEALING LIQUID ENCLOSE. REMOVE THIS PLUG ONLY AFTER SEAL IS CONNECTED TO GAUGE
1/4 STD PIPE THREAD CONNECT THIS END TO GAUGE LINE

FIXTURE 33A



Sealing fluid is shipped in seal and ends of union are capped. Bottom plug should not be removed until seal is attached to gauge.

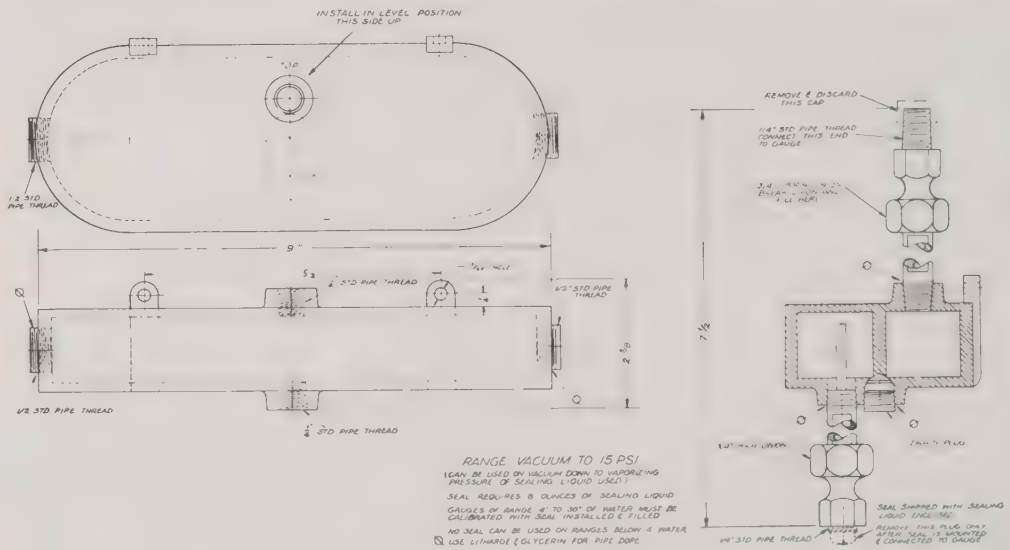
Not suitable for use on vacuum.

FOR PRESSURE MEDIUM

HEAVIER THAN

SEALING FLUID

FIXTURE 33B

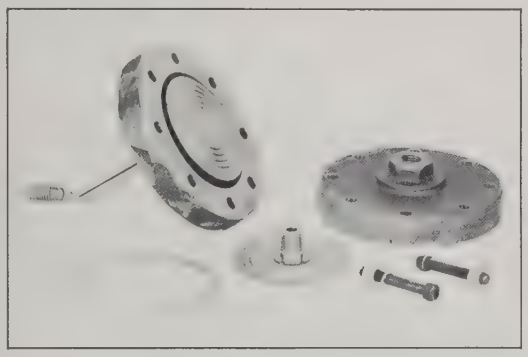

INSTALL IN LEVEL POSITION THIS SIDE UP
1/2 STD PIPE THREAD
9"
5/8
1/2" STD PIPE THREAD
1/2 STD PIPE THREAD
1/4" STD PIPE THREAD
2 5/8
REMOVE & DISCARD THIS CAP
1/4" STD PIPE THREAD CONNECT THIS END TO GAUGE
7 1/2
1/2" M.S.M. UNION
SEAL SHIPPED WITH SEALING LIQUID ENCLOSED. REMOVE THIS PLUG ONLY AFTER SEAL IS MOUNTED & CONNECTED TO GAUGE
1/4" STD PIPE THREAD
RANGE VACUUM TO 15 PSI
CAN BE USED ON VACUUM DOWN TO VAPORIZING PRESSURE OF SEALING LIQUID USED
SEAL REQUIRES 8 OUNCES OF SEALING LIQUID
GAUGES OF RANGE 4" TO 30" OF WATER MUST BE CALIBRATED WITH SEAL INSTALLED & FILLED
NO SEAL CAN BE USED ON RANGES BELOW 4 WATER
USE LITHARGE & GLYCERIN FOR PIPE DOPE

FIXTURE 32 - LOW PRESSURE SEALING CHAMBER FOR SEALING LIQUIDS HEAVIER THAN PRESSURE MEDIA

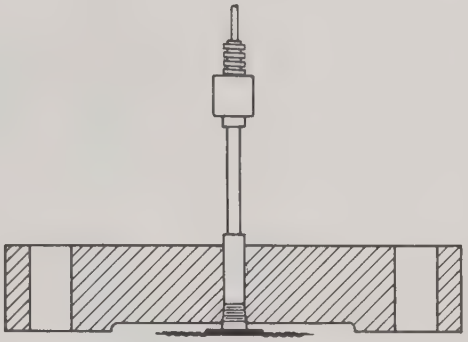
DESCRIPTION	PART NUMBER
Fixture 25, Seal, Type E, Consisting of two parts:	
Coil Pipe Syphon of brass	33111
Union Cock, of brass with lever handle	33122
Fixture 32, Type C for pressure from 0 to 15 lb. Cast Iron	7260
Fixture 33A, Seal for pressure medium lighter than sealing fluid range 15-500 lb.	
Cast Iron Body with Steel Tubes	22545
Cast Bronze Body with Lead Tubes	20620
Not suitable for use on vacuum.	
Sealing fluid is shipped in seal and ends of unions are capped.	
Bottom plug should not be removed until seal is attached to gauge.	
Fixture 33B, Seal for pressure from 15-500 psi, Cast Iron Body with Steel Tube for	
Mercury	
all of Stainless Steel, (302)	
all of Stainless Steel, (316)	

VOLUMETRIC SEALS

For Ranges from 50 psi to 500 psi
Special to 10,000 psi. (See page 4)



Parts of Volumetric Seal



Capsule mounted special on Blind Flange

(316 S.S. Capsules) Ranges 0-50 psi to 0-500 psi*
For more details see under Product Data G634.2-2

	With 5 feet armored extension, filled system assembled to Pressure Gauge. ADD:				*Without extension tubing for use with small indicating gauges and sold to customers who have proper facilities for evacuating and mounting.*
Stainless Steel (316) Flanges	SERIES 500	MODEL 93	77C 80C	MODEL 87	
Cleanable Seal, capsule type	9F1	9F1A	9F1B	9F1C	*9F11*
Cleanable Seal, capsule type, with 4 5/16" O.D. bottom casting with 1/2" IPS internal intake. No purge holes.	9F3	9F3A	9F3B	9F3C	*9F7*
Cleanable Seal, capsule type, with 4 5/16" O.D. bottom casting with 1/2" IPS internal intake. With 1/8" purge holes.	9F4	9F4A	9F4B	9F4C	*9F8*
Steel Flanges					
Cleanable Seal, capsule type	9F2	9F2A	9F2B	9F2C	*9F12*
Cleanable Seal, capsule type, with 4 5/16" O.D. bottom casting with 1/2" IPS internal intake. No purge holes.	9F5	9F5A	9F5B	9F5C	*9F9*
Cleanable Seal, capsule type, with 4 5/16" O.D. bottom casting with 1/2" IPS internal intake. With 1/8" purge holes.	9F6	9F6A	9F6B	9F6C	*9F10*

Extra length of armored tubing: (Feet of length approved = 10,000 divided by temperature span in deg. F)
Bronze armor of copper capilliary tubing
Stainless Steel armor over stainless steel capilliary
Series 500 seals may be modified at no extra cost and calibrated with Model 40

*Temperature must always be specified with pressure range to insure use of proper filling liquid. Also state elevation of seal relative to the instrument level.

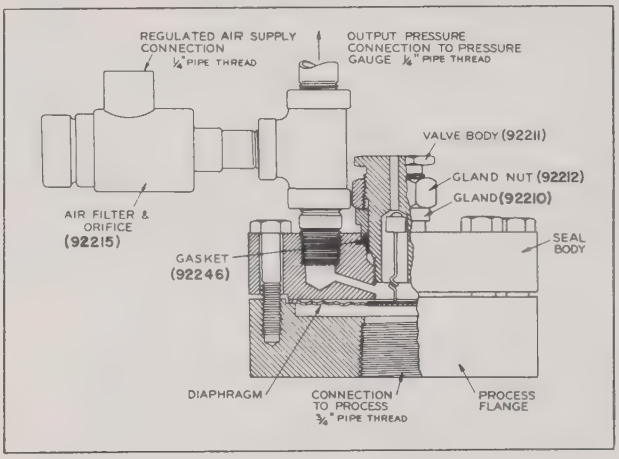
*Compound ranges satisfactory for minimum span of 45 psi with seal at instrument level or above (30 in mv to 30 psi)
If seal is below instrument vacuum ranges are limited as follows:
Seal 5 ft. below, 18 in mer. vac. 10 ft. below = 15 in mv, 15 ft. below = 10 in. mv,
20 ft. = 5 in. mv, 25 ft. = 0 mv.

*For pressures up to 10,000 psi, the capsule type seal, appropriate type 9F1, 9F1B or 9F1C, may be furnished with a standard pipe flange by specifying the flange rating. Write Waterbury for price of flange with capsule auxiliary.

PNEUMATIC FORCE-BALANCE SEAL

(More details in Product Data G634.3-2)

Minimum range 0-12" water, maximum range 0-100 psi (for temperatures 0-250F-at seal)



For Seal with 316 Stainless Steel process flange and diaphragm:
(also includes brass air filter with orifice)

3/4" IPS internal connection 9F30
3", 150 lb. Std. flange connection ...9F31

Diaphragm Facing Variations:
Steel, Copper, Monel
Silver
Tantalum
Tantalum facing on 3" flange, not including price of facing on diaphragm

Differential pressure regulator....Part 95884

PARTS LIST NO. Y19807
SERIES 500
8 & 12 INCH STANDARD AND PORTABLE RECORDERS--INDICATORS--ACCESSORIES

- C O N T E N T S -

	PAGE NUMBER
BASIC RECORDER	2, 3 & 4
BASIC PORTABLE RECORDER	2, 3 & 4
BASIC DIAL TYPE INDICATOR	2, 3 & 4
PEN ARMS	5
PENS	5
PEN MOUNTINGS	6 & 7
CAPILLARY INKING SYSTEMS	8 & 9
INK	10
SPRING CHART DRIVES	11
ELECTRIC CHART DRIVES	11&12

THE BRISTOL COMPANY WATERBURY, CONN. 06720

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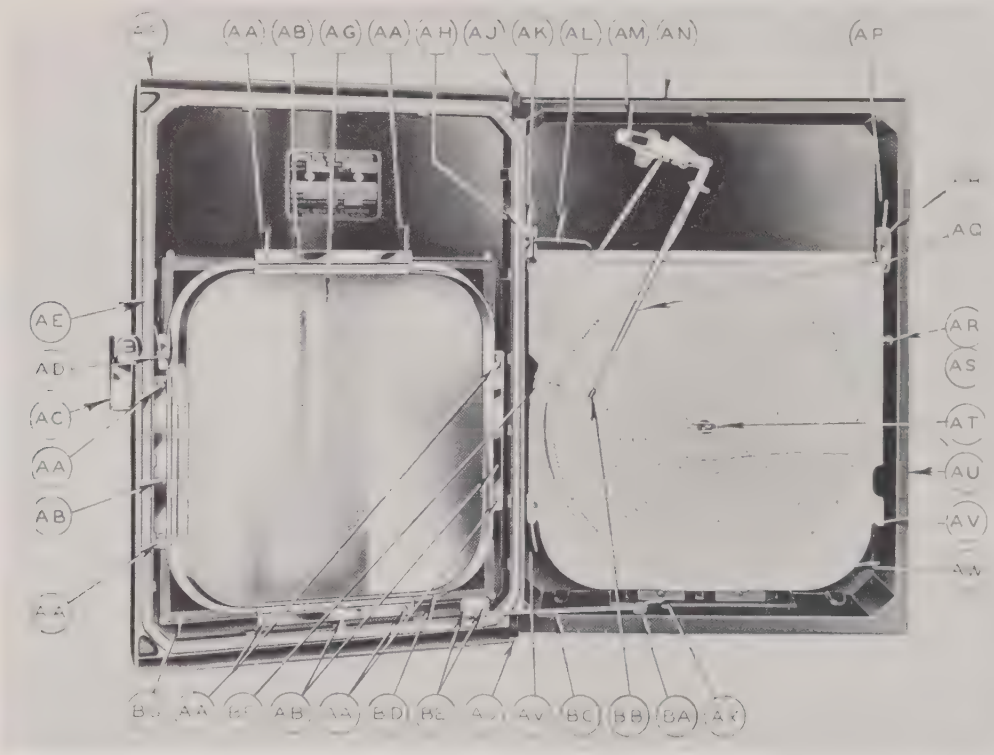


FIGURE 1. SERIES "500" RECORDER

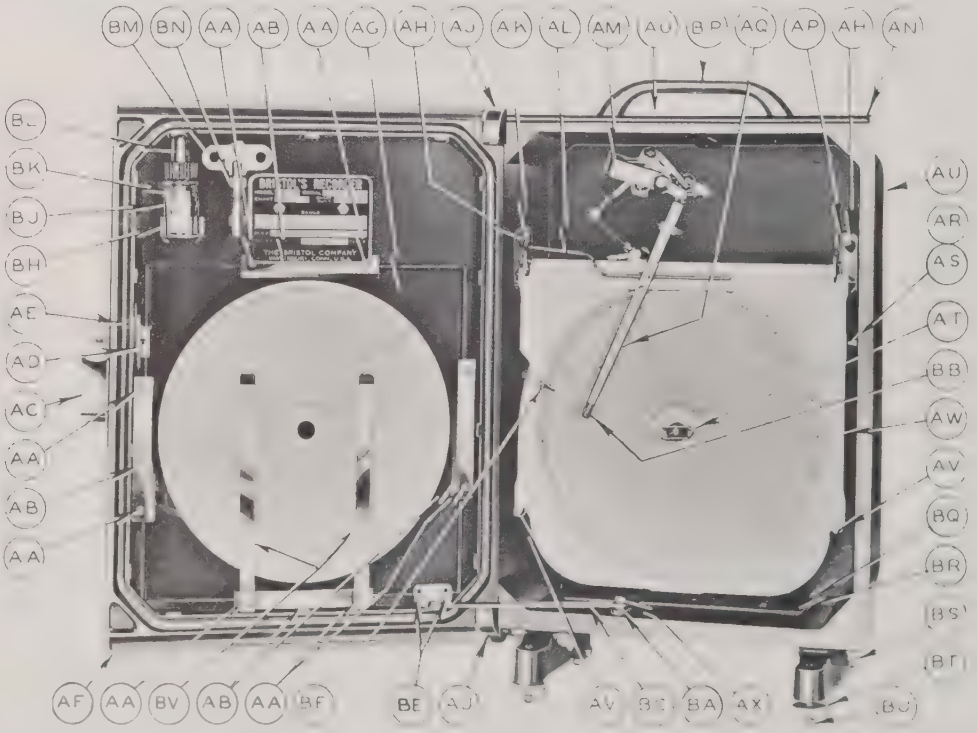


FIGURE 2. SERIES "500" PORTABLE RECORDER

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

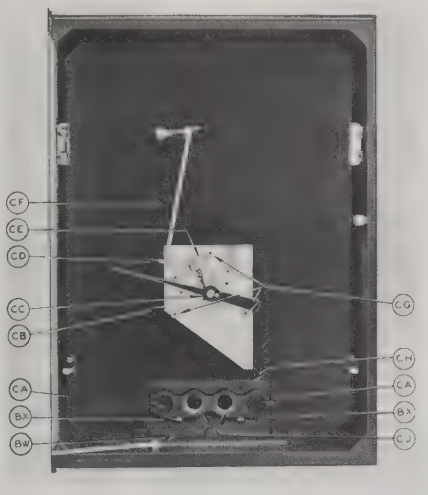


FIGURE 3. SERIES "500" INDICATOR

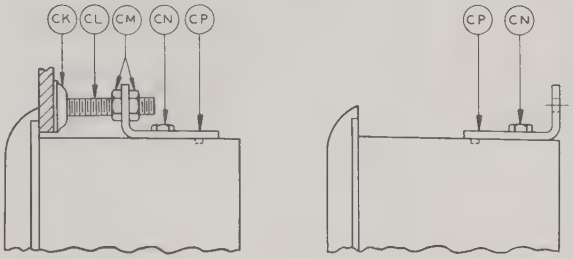


FIGURE 4. UNIVERSAL MOUNTING BRACKET

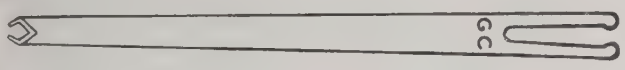
ITEM	PART NUMBER	DESCRIPTION
AA	82656	6 x 1/4" Self-tapping screw
AB	82663	Glass clips, sides and bottom for 8" case
	82637	Glass clips, sides and bottom for 12" case
	89261	Glass clips, top for 8" case
	89262	Glass clips, top for 12" case
AC	B3762	Door handle without lock
	B3763	Door handle with lock
NOT SHOWN	94738	Latch plate, used with P/N 3763
	A14184	Flat spring, used with item AC
	A15405	Key for door lock
AD	B3756	Hook
	A14186	Clamp
	A14185	Nut
	51556	Screw
AE	82608	Door gasket; order 45" for 8" case or 62" for 12" case
AF		Case cover; order by model and serial number of instrument
AG	82662	Glass for door of 8" case
	82643	Glass for door of 12" case
	86515	Blank for door of 8" portable case
	86809	Blank for door of 12" portable case
AH	85812	10 x 5/16" Screw
AJ	82654	Hinge-pin bracket
NOT SHOWN	92694	10-32 x 1/2" Fillister-head screw for item AJ
	10075	Washer for above screw
AK	82650	Left-hand, chart-plate bracket
AL	90146	Pen lifter for 8" case
	82648	Pen lifter for 12" case
NOT SHOWN	90147	Pen lifter bracket for 8" case
	84103	Pen lifter bracket for 12" case
	86804	6-40 x 1/4" Screw for mounting above bracket
	43040	Washer for above screw
AM		Pen mounting, (see pages 6 and 7)
NOT SHOWN	66541	10-32 x 1/2" Screw for mounting item AM
	10075	Washer for above screw
AN		Case body; Order by model and serial number of instrument
AP	82651	Right-hand chart-plate bracket
AQ		Pen arm (see Figure 5)
AR	71283	Roller for door hook
AS	82638	Roller pin
AT	74986	Chart hub (standard)
	86771	Chart hub for dairy recorders
AU		Case complete; order by model and serial number of instrument
AV	82633	Spring catch for chart plate

NOTE: Case sizes are determined by the nominal chart or dial dimensions: 8" and 12"

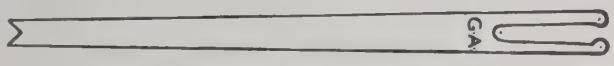
BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	PART NUMBER	DESCRIPTION
NOT SHOWN	82634	6-40 Screw for mounting item AV
	20903	6-40 Nut for above screw
AW	84727	Standard chart plate for 8" case
	84728	Standard chart plate for 12" case
	87674	Chart plate for 12" integrating flowmeter
AX	87392	Door-stop screw
BA	44739	Collar for door-stop screw
BB		Pen (see Figure 6)
BC	86520	Door stop complete for 8" case
	86522	Door stop complete for 12" case
BD	82657	Aluminum shield for 8" case
	82642	Aluminum shield for 12" case
	82659	Aluminum shield for 534 case
BE	40066	8-32 x 1/4" Fillister-head screw
	18372	8-36 x 1/4" Fillister-head screw for 534 case
BF	84724	Time index
NOT SHOWN	67694	2-64 x 3/16" Screw for mounting item BF
	87118	2-64 Hexagon nut for above screw
BG	84725	Gasket, under glass or metal blank. 34" for 8" case, 43" for 12" case
BH	38288	Bottle clip (2 used on 2-pen instrument)
NOT SHOWN	39425	10-32 x 1/4" Screw for above clip (item BH)
	86545	10 x 3/16" Self-tapping screw (used on early models)
BJ	86526	Mounting plate to hold bottle and key clips
NOT SHOWN	86298	Mounting plate stud for item BJ
	13775	Nut for above stud
BK	70628	1/4 oz. ink bottle (2 used on 2-pen instrument)
BL	86546	Bottle cap and dropper
BM	84450	Chart-drive key
BN	86527	Spring clip for chart-drive key
NOT SHOWN	18339	6-40 x 1/4" Screw for above clip (item BN)
	83999	6 x 3/16" Self tapping screw (used on early models)
BP	83051	Handle
NOT SHOWN	66541	10-32 x 1/2" Fillister-head screw for mounting handle (item BP)
	20843	Washer for above screw
BQ	89650	1/4"-20 x 1/4" Set screw
BR	67029	10-32 x 5/16" Fillister-head screw
BS	83053	Foot complete (includes items BT and BU)
	83050	Foot (casting only, drilled, tapped and finished)
NOT SHOWN	38451	1/4"-20 x 1/2" Fillister-head screw for mounting foot (item BS)
	39714	Washer for above screw
BT	82626	Leveling-screw knob
BU	82625	Leveling screw
BV	86514	Clip for extra charts (8" Case)
	86753	Chart clip for 12" case
BW	82653	Connection-mounting plate (solid)
BX	66546	10-32 x 1" Fillister-head screw
CA	82664	Blank Plug
NOT SHOWN	84729	Hexagon nut for 1/2" conduit connection
	84681	Rubber grommet for electrical connection
CB	86794	Mounting plate for multiplier unit
CC	72791	Pointer for 8" case
	72908	Pointer for 12" case
NOT SHOWN	87345	Zero stop bracket
	87909	Outer dial plate blank for 12" recorders
	87908	Inner dial plate blank for 12" recorders
	87346	Dial plate blank for 8" recorders
CD	86795	Lever arm for multiplier unit
CE	76885	Multiplier unit for gauges and metameters
	71305	Multiplier unit for thermometers and flowmeters
NOT SHOWN	86791	Post for mounting multiplier unit (item CE)
CF		Linkage to measuring element; order by model and serial number of instrument
CG	83106	Post for dial plate
CH	82674	Connection mounting plate (top half)
CJ	83998	Connection mounting plate (bottom half)
CK	92031	Cup washer
CL	83848	Screw
CM	50706	Nut
CN	32193	Screw
CP	92030	Mounting bracket

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS



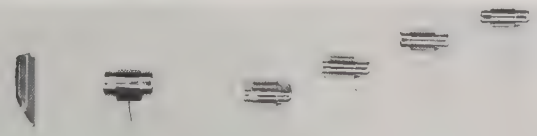
V-PEN ARM



FOUNTAIN-PEN ARM

FIGURE 5. SERIES "500" PEN ARMS

DESCRIPTION	PART NO.
Pen arm marked:	
FA.....	84348
FB.....	84349
FC.....	84350
FD.....	84351
FE.....	83728
FG.....	90651
FH.....	90650
FJ.....	93188
FK.....	93189
FL.....	94014
GA.....	83725
GB.....	83727
GC.....	83724
GJ.....	94073
GK.....	94074



PA PB PC PD PE PF

FIGURE 6. FOUNTAIN PENS

ITEM	PART NUMBER	DESCRIPTION
PA	42648	V-pen for single pen or 2-pen divided chart instrument
	42650	V-pen with closed back for 2-pen instrument
	42649	V-pen with open back for 2-pen instrument
PB		Fountain pen for 1-pen instruments (except free-vane controllers) and 2-pen divided chart instruments. 3-drop pens are standard, but 6-drop pens may be used in flowmeters, ammeters, voltmeters and all metameter receivers.
	30425	Standard bore 3-drop pen
	46108	Fine bore 3-drop pen
	42909	Standard bore 6-drop pen
	82499	Fine bore 6-drop pen
PC	32914	Pen for 1-pen free-vane controller or nearest chart in multiple pen instrument
PD	32915	Pen, second from chart in multiple pen instrument
PE	32916	Pen, third from chart in multiple pen instrument
PF	28577	Pen, fourth from chart in multiple pen instrument
NOT SHOWN	32900	Pen cleaning wire

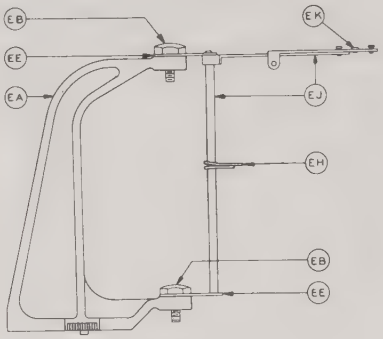


FIGURE 7

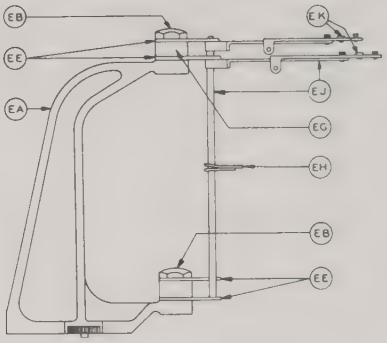


FIGURE 8A

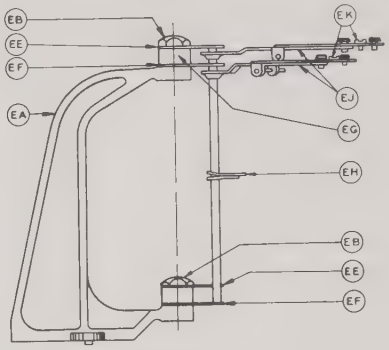


FIGURE 8B

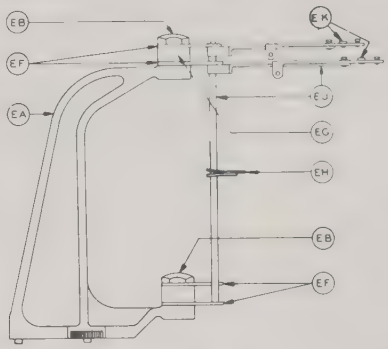


FIGURE 8C

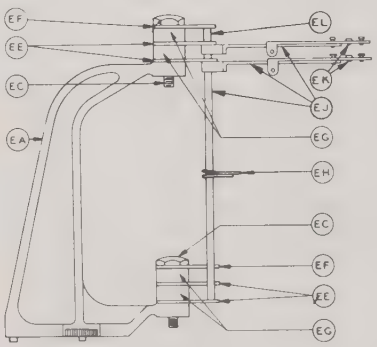


FIGURE 8D

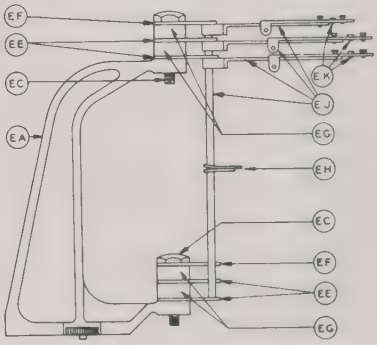


FIGURE 9A

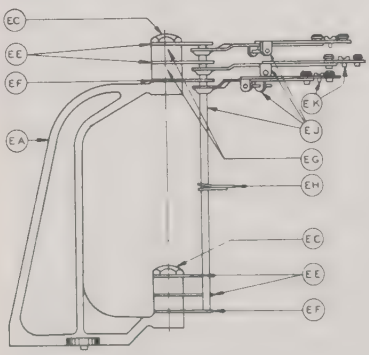


FIGURE 9B

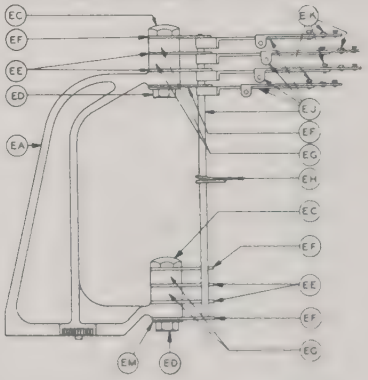
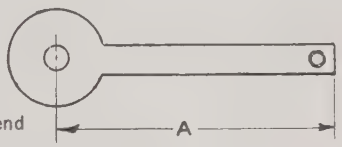


FIGURE 10

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	PART NUMBER	DESCRIPTION
FIGURE 7	84703	Standard single-pen-mounting complete, for 8" or 12" cases
	89974	Metavane transmitter complete, for 8" case only
FIGURE 8A	84704	Standard 2-pen mounting complete, for 8" or 12" cases
	86415	1-pen, 1-control unit, free-vane controller pen mounting complete, for 12" case only
FIGURE 8B	91695	2-pen mounting complete, for flowmeter with pressure pen for 8" or 12" cases
FIGURE 8C	91292	8" Indicating free-vane controller pen mounting complete
	88277	12" Indicating free-vane controller pen mounting complete
FIGURE 8D	88291	12" Autoset free-vane controller pen mounting complete
FIGURE 9A	84705	Standard 3-pen mounting complete, for 12" case
	86430	2-pen, 1-control unit, free-vane controller pen mounting complete, for 12" case
FIGURE 9B	91696	Flowmeter with pressure and temperature, 3-pen mounting complete for 12" case
FIGURE 10	84706	Standard 4-pen mounting complete, for 12" case only
	86432	2-pen, 2-control unit, free-vane controller pen mounting complete for 12" case
EA	84701	Standard pen arm mounting
	86412	Pen arm mounting for free-vane controller
EB	84170	6-40 x 7/16" Screw
EC	84171	6-40 x 15/16" Screw
ED	20903	6-40 Hexagon nut
EE	84272	Short tab (item EF used on metavane transmitter)
EF	84271	Long tab
EG	84172	Spacer
EH	84110	Straight lever arm with six holes
		Straight lever arm with one hole at outer end
	89972	Dimension A = 15/16"
	88280	Dimension A = 1"
	91291	Dimension A = 1 1/16"
	86433	Dimension A = 1 5/16"
	86486	Dimension A = 1 9/16"
		Straight lever arm with one tapped hole at outer end
	88278	Dimension A = 1 1/16"
	91289	Dimension A = 1 1/8"
	86435	Dimension A = 1 13/32"
	86414	Dimension A = 1 3/4"
	83734	Offset lever arm with four holes
	86437	Offset lever arm with one tapped hole
EJ	84270	Base end and shaft complete
	90809	Base end and shaft complete, for metavane transmitter
EK	82591	1-72 x 3/32" Special-head screw (included in item EJ)
EL	84107	Shaft for autoset unit
EM	87148	Washer



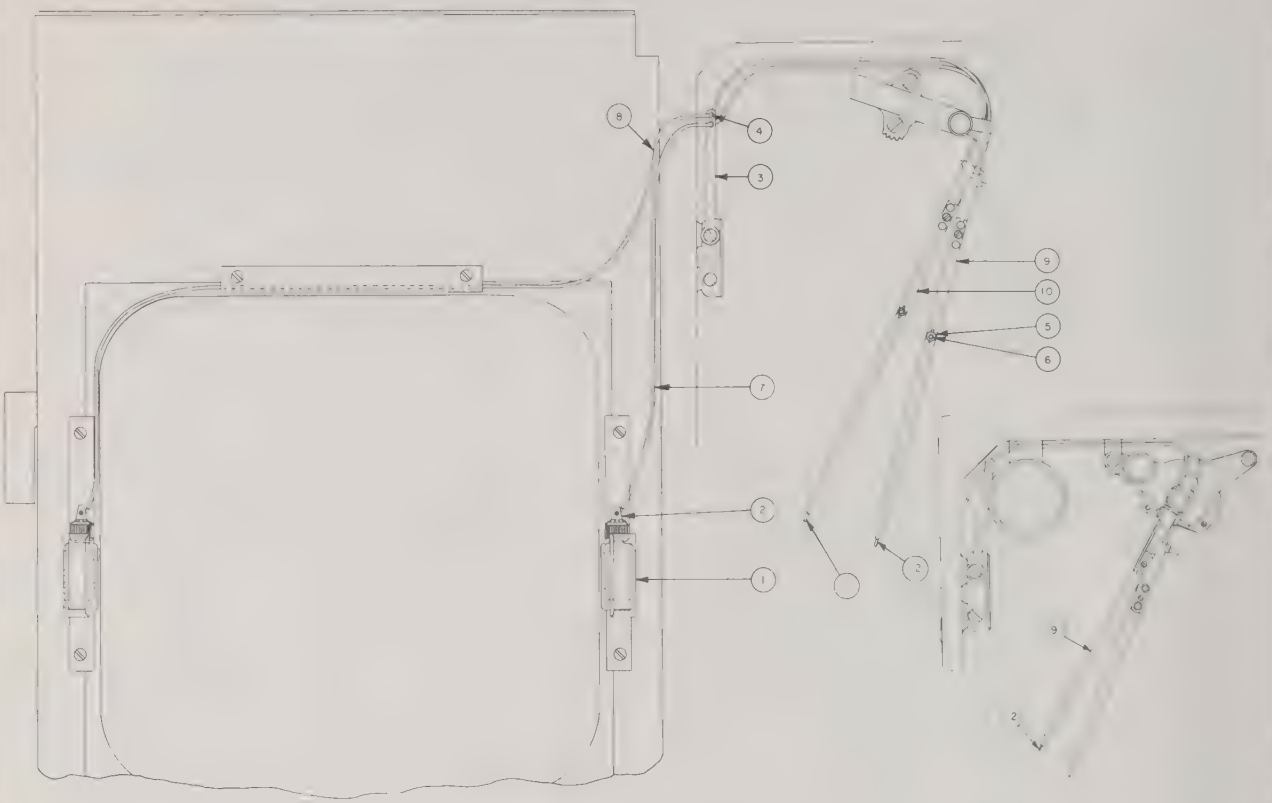


FIGURE 11. CAPILLARY PEN SYSTEM FOR ONE AND TWO PEN RECORDERS.

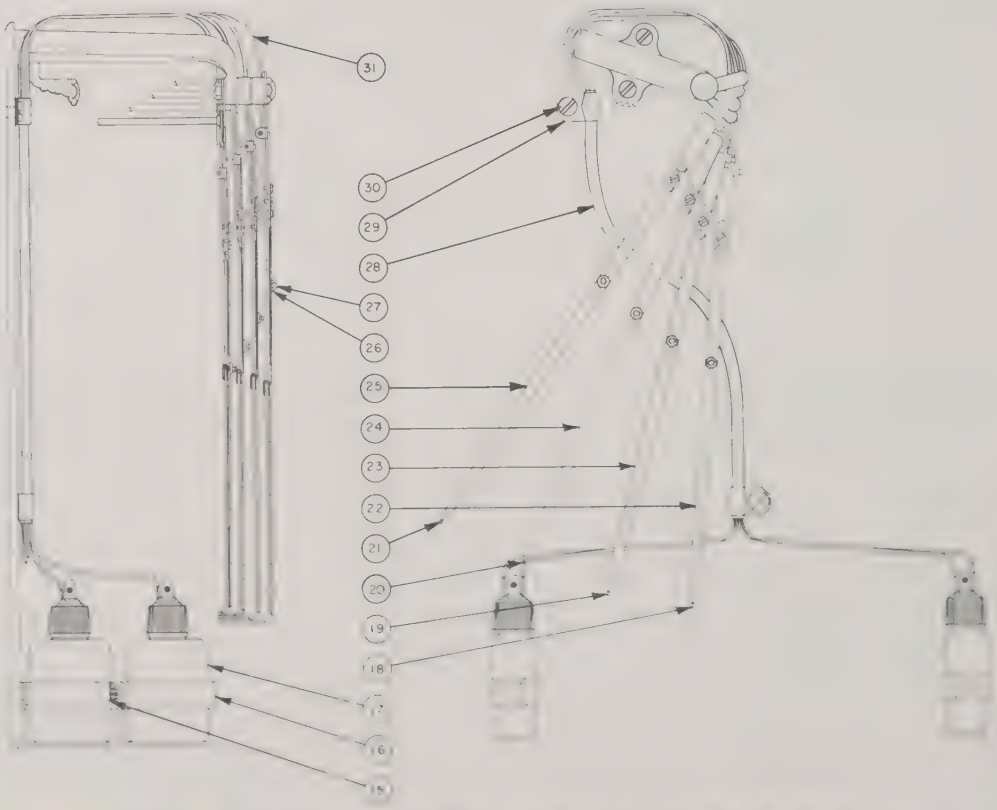


FIGURE 12. CAPILLARY PEN SYSTEMS FOR THREE & FOUR PEN RECORDERS.

CAPILLARY INKING SYSTEMS

ITEM	PART NO.	DESCRIPTION	
USED ON ALL CAPILLARY INKING SYSTEMS EXCEPT 3 & 4 PEN			
1	A8880	Clip	AS REQUIRED
2	A8889	Bottle assembly	1 Bottle red ink 98340
3	A8883	Tube support	1 Bottle blue ink 98341
4	A8884	Sleeve	
5	36647	Washer	
6	A8878	Special hex nut	
ATTACHMENT Z35A - CAPILLARY INKING SYSTEM FOR 1-PEN, 8", SERIES 530 RECORDER (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).			
7	A8848	Feed tube (21 1/2" long)	
9	A8885	Pen arm	
12	A9697	Pen assembly	
ATTACHMENT Z35B - CAPILLARY INKING SYSTEM FOR 2-PEN, 8", SERIES 530 RECORDER (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).			
7	A8848	Feed tube (21 1/2" long)	
8	A8848	Feed tube (27 1/2" long)	
9	A8885	Pen arm (red)	
10	A8886	Pen arm (blue)	
11	A9699	Pen assembly (blue)	
12	A9697	Pen assembly (red)	
ATTACHMENT Z37 - CAPILLARY INKING SYSTEM FOR 1-PEN, 12", SERIES 532 AIR CONTROL (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).			
7	A10129	Feed tube (21 1/2" long)	
9	A8882	Pen arm	
12	A9698	Pen assembly	
ATTACHMENT Z37A - CAPILLARY INKING SYSTEM FOR 1-PEN, 12", SERIES 500 AIR CONTROL (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).			
7	A10129	Feed tube (21 1/2" long)	
10	B2403	Pen arm (red)	
11	A9691	Pen assembly	
ATTACHMENT Z37B - CAPILLARY INKING SYSTEM FOR 2-PEN, 12", SERIES 500 AIR CONTROL (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).			
7	A8848	Feed tube (21 1/2" long)	
8	A8848	Feed tube (31 1/2" long)	
9	B2403	Pen arm (red)	
10	B2497	Pen arm (blue)	
11	A9692	Pen assembly (blue)	
12	A9691	Pen assembly (red)	
ATTACHMENT Z37C - CAPILLARY INKING SYSTEM FOR 1-PEN, 12", SERIES 502 AIR CONTROLLER (Includes items 1 thru 6 above plus the following).			
7	A10129	Feed tube (order 21 1/2" length)	
9	B2497	Pen arm	
12	A9695	Pen assembly	
ATTACHMENT Z37D - CAPILLARY INKING SYSTEM FOR 2-PEN, 12", SERIES 502 AIR CONTROLLER (Includes items 1 thru 6 above plus the following)			
7	A10129	Feed tube (order 21 1/2" length)	
8	A10129	Feed tube (order 31 1/2" length)	
9	B2497	Pen arm (red)	
10	B2403	Pen arm (blue)	
11	A9694	Pen assembly (blue)	
12	A9695	Pen assembly (red)	

ITEM	PART NO.	DESCRIPTION
ATTACHMENT Z38A - CAPILLARY INKING SYSTEM FOR 1-PEN, 12", SERIES 500 RECORDER (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).		
7	A10129	Feed tube (24" long)
9	B2403	Pen arm
12	A9694	Pen assembly
ATTACHMENT Z38B - CAPILLARY INKING SYSTEM FOR 2-PEN, 12", SERIES 500 RECORDER (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).		
7	A10129	Feed tube (24" long)
8	A10129	Feed tube (35" long)
9	B2403	Pen arm (red)
10	B2497	Pen arm (blue)
11	B9695	Pen assembly (blue)
12	B9694	Pen assembly (red)
ATTACHMENT Z38C - CAPILLARY INKING SYSTEM FOR 3-PEN, 12", SERIES 500 RECORDER (Refer to Figure 12).		
15	A6180	Special nut
16	A6362	Bracket
17	A6356	Bottle
19	A9694	Pen assembly (red)
20	A9695	Pen assembly (blue)
21	A9696	Pen assembly (black)
23	B2403	Pen arm (red)
24	B2497	Pen arm (blue)
25	B2498	Pen arm (black)
26	A8878	Special hex nut
27	36647	Washer
28	A6179	Guide tube
29	39425	#10-32 x 1/4" Special Fillister-head screw
30	95379	Clamp
31	A10129	Feed tube, (90", makes three tubes)
ATTACHMENT Z38D - CAPILLARY INKING SYSTEM FOR 4-PEN, 12", SERIES 500 RECORDER (Refer to Figure 12).		
15	A6180	Special nut
16	A6362	Bracket
17	A6356	Bottle
18	A9690	Pen assembly (purple)
19	A9691	Pen assembly (red)
20	A9692	Pen assembly (blue)
21	A9693	Pen assembly (black)
22	B2726	Pen arm (purple)
23	B2403	Pen arm (red)
24	B2497	Pen arm (blue)
25	B2498	Pen arm (black)
26	A8878	Special hex nut
27	36647	Washer
28	A6179	Guide tube
29	39425	Special Fillister-head screw
30	95379	Clamp
31	A10129	Feed tube (120", makes four tubes)

STANDARD INK

BOTTLE SIZE	TEMPERATURE RANGE +10°F TO +160°F					
	RED	BLUE	GREEN	BLACK	PURPLE	ORANGE
1 oz. (with dropper)	6883	19084	28134	31673	26475	A8229
2 oz.	40024	47971	40025	40026	40028	
4 oz.	47975	47976	47977	47979	47978	98338
1/2 pint	47980	47981	47982	47984	47983	
1 pint	47985	47986	47987	47989	47988	
1 quart	47990	47991	47992	47994	47993	
1 gallon	65500	65501	65502	65504	65503	

LOW TEMPERATURE INK

BOTTLE SIZE	TEMPERATURE RANGE -65°F TO +80°F			
	RED	BLUE	GREEN	PURPLE
1 oz. (with dropper)	85601	85613	85607	A9604
4 oz.	85602	85614	85608	A9605
1/2 pint	85603	85615	85609	A9606
1 pint	85604	85616	85610	A9607
1 quart	85605	85617	85611	A9608
1 gallon	85606	85618	85612	A9609

HIGH TEMPERATURE INK

BOTTLE SIZE	TEMPERATURE RANGE +60°F TO +500°F			
	RED	BLUE	GREEN	BLACK
1 oz.	83429			A8231
4 oz.	83430		A8225	
1/2 pint	83431			
1 pint	83432	A8695		
1 quart	83433			
1 gallon	83434			

QUICK DRYING INK

BOTTLE SIZE	TEMPERATURE RANGE +32°F TO +125°F					
	RED	BLUE	GREEN	PURPLE	BLACK	ORANGE
1 oz.	88950	88951	A3868	A3869		A8230
2 oz.	71234	A8227				
4 oz.	88952	88953	A8222		A8223	A8224
1/2 pint	88954	88955				
1 pint	88956	88957	A8693	A8694		
1 quart	88958	88959				

HIGH HUMIDITY INK

BOTTLE SIZE	TEMP. RANGE +35°F TO +125°F		
	RED	BLUE	BROWN
1 oz.	A3697	A6222	
2 oz.	A2572		A3499

ALL PURPOSE INK

BOTTLE SIZE	TEMP. RANGE -35°F TO +150°F		
	RED	BLUE	
1 oz.	A10055	A10060	
1 pint	A10056	A10061	
1 quart	A10057	A10062	
1 gallon	A10058	A10063	

DESCRIPTION	PART NO.
STANDARD SPRING CHART DRIVES:	
SINGLE SPEED	
12 hour, 9 day wind	370341-02-3
24 hour, 9 day wind	370341-01-5
48 hour, 9 day wind	370341-03-1
7 day, 9 day wind	370341-04-0
8 day, 9 day wind	370341-05-8
30 day, 32 day wind	370341-06-6
31 day, 32 day wind	370341-07-4
TWO SPEED	
7 day or 24 hour, 8 day wind	370341-11-2
24 or 96 minute, 30 hour wind	370341-12-0
7 day or 48 hour, 8 day wind	370341-13-4
3 day or 24 hour, 8 day wind	370341-14-2
8 hour or 2 hour, 30 hour wind	370341-15-0
8 day or 24 hour, 8 day wind	370341-16-9
OVEN TEMPERATURE RECORDER SPRING CHART DRIVES:	
8 hour or 2 hour, 8 hour wind	370341-18-0
1 hour or 3 hour, 8 hour wind	370341-19-8
CHART DRIVE OIL	
1 oz. bottle (for temperatures - 20°F to +120°F)	A3885
2 oz. bottle (for temperatures +100°F to +400°F)	95750
ELECTRIC DUPLEX (COMBINATION SPRING & ELECTRIC) CHART DRIVES:	
24 hour, 115V./60 Hz.	89272
72 hour, 115V./60 Hz.	89272-002
7 day, 115V./60 Hz.	89273

ELECTRIC, SINGLE-SPEED CHART DRIVES:

SPINDLE SPEED	VOLTAGE & FREQUENCY	PART NO. COMPLETE	MOTOR ONLY	ROTOR & PINION	FIELD COIL
30 Min.	120 V. 60 C.	86212	SEE NOTE 1	83033	
96 Min.	120 V. 60 C.	87352	86562	83032	45621
	120 V. 50 C.	87353	SEE NOTE 2	83473	45618
	120 V. 25 C.	87354	86563	83474	45609
	240 V. 60 C.	87355	86560	83032	45622
	240 V. 50 C.	87356	86561	83473	
	240 V. 25 C.	87357	87350	83474	45610
4 Hr.	120 V. 60 C.	89757	86562	83032	45621
	120 V. 50 C.	89758	SEE NOTE 2	83473	45618
	120 V. 25 C.	89759	86563	83474	45609
	240 V. 60 C.	89760	86560	83032	45622
	240 V. 50 C.	89761	86561	83473	
	240 V. 25 C.	89762	87350	83474	45610
8 Hr.	120 V. 60 C.	86218	86562	83032	45621
	120 V. 50 C.	86854	SEE NOTE 2	83473	45618
	120 V. 25 C.	86855	86563	83474	45609
	240 V. 60 C.	86856	86560	83032	45622
	240 V. 50 C.	86857	86561	83473	
	240 V. 25 C.	86858	87350	83474	45610
12 Hr.	120 V. 60 C.	86220	86562	83032	45621
	120 C. 50 C.	86858	SEE NOTE 2	83473	45618
	120 V. 25 C.	86859	86563	83474	45609
	240 V. 60 C.	86860	86560	83032	45622
	240 V. 50 C.	86861	86561	83473	
	240 V. 25 C.	87359	87350	83474	45610
24 Hr.	120 V. 60 C.	86221	86562	83032	45621
	120 V. 50 C.	86222	SEE NOTE 2	83473	45618
	120 V. 25 C.	86223	86563	83474	45609
	240 V. 60 C.	86862	86560	83032	45622
	240 V. 50 C.	86863	86561	83473	
	240 V. 25 C.	87360	87350	83474	45610
48 Hr.	120 V. 60 C.	86224	86562	83032	45621
	120 V. 50 C.	86864	SEE NOTE 2	83473	45618
	120 V. 25 C.	86865	86563	83474	45609
	240 V. 60 C.	86866	86560	83032	45622
	240 V. 50 C.	86867	86561	83473	
	240 V. 25 C.	87361	87350	83474	45610
72 Hr.	120 V. 60 C.	86225	86562	83032	45621
	120 V. 50 C.	86868	SEE NOTE 2	83473	45618
	120 V. 25 C.	86869	86563	83474	45609
	240 V. 60 C.	86870	86560	83032	45622
	240 V. 50 C.	86871	86561	83473	
	240 V. 25 C.	87362	87350	83474	45610
7 Day	120 V. 60 C.	86226	86562	83032	45621
	120 V. 50 C.	86307	SEE NOTE 2	83473	45618
	120 V. 25 C.	86227	86563	83474	45609
	240 V. 60 C.	86872	86560	83032	45622
	240 V. 50 C.	86873	86561	83473	
	240 V. 25 C.	87363	87350	83474	45610
30 Day	120 V. 60 C.	86230	86562	83032	45621
	120 V. 50 C.	86874	SEE NOTE 2	83473	45618
	120 V. 25 C.	86875	86563	83474	45609
	240 V. 60 C.	86876	86560	83032	45622
	240 V. 50 C.	86877	86561	83473	
	240 V. 25 C.	87364	87350	83474	45610

NOTE 1: Use part 86562 with rotor 83033 in place of 83032.

NOTE 2. Use part 86562 with rotor 83473 in place of 83032.

CASE CONNECTIONS & MEASURING SYSTEM COLOR CODE FOR DIAL INDICATING & RECORDING PRESSURE GAUGES-1 TO 4 PENS

THE BRISTOL CO.
WATERBURY, CONN., U.S.A.
DATE 7-21-47 DRAWN JJR
DRAWER NO. 21
SHEET NO. 0.0776

REV. 4-12-48

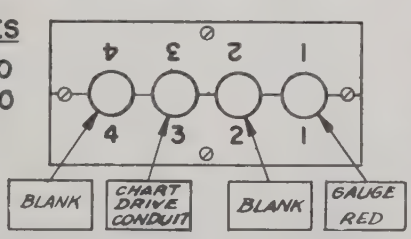
MAKE PRESSURE UNION & CONDUIT CONNECTIONS TO NUMBERED POSITIONS OF SPLIT CONNECTION PLATE AS SHOWN BELOW

NOTE.
1. ALL CONDUIT CONNECTIONS ARE FOR 1/2" S.P.T.
2. OMIT CHART DRIVE CONDUIT FOR INDICATORS AND SPRING DRIVEN RECORDERS.

NUMBERS ARE FROM RIGHT TO LEFT LOOKING FROM REAR OF CASE

1 PEN GAUGES

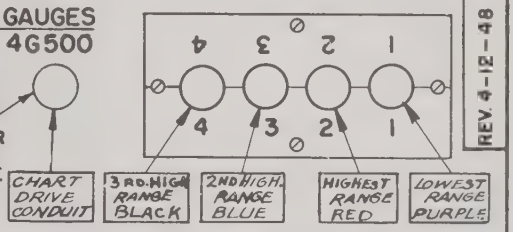
MODEL 1G500
" 1G530



4 PEN GAUGES

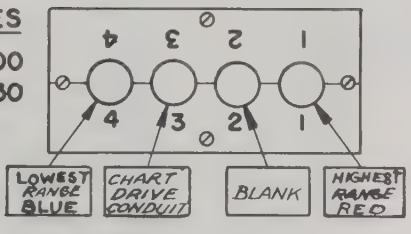
MODEL 4G500

SPECIAL DRILL IN CASE FOR RUBBER GROMMET.



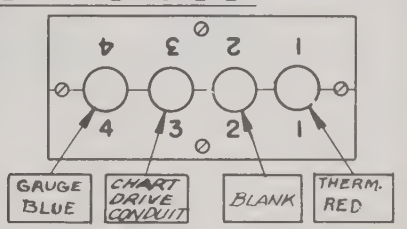
2 PEN GAUGES

MODEL 2G500
" 2G530



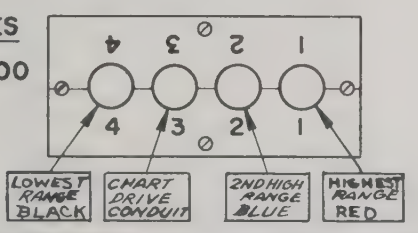
2 PEN - 1 GAUGE & 1 THERMOMETER

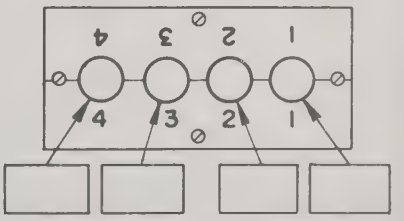
MODEL 2L500
" 2L530



3 PEN GAUGES

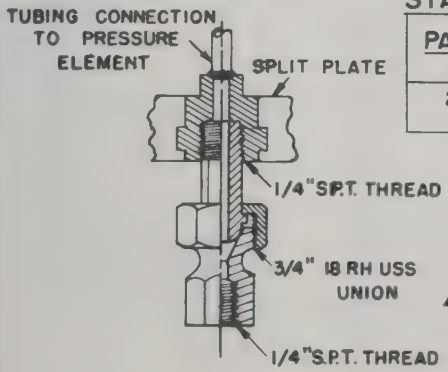
MODEL 3G500





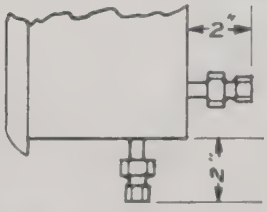
STANDARD PRESSURE GAUGE UNIONS

PART NO.	MATERIAL	RANGE
3855	PLATED BRASS	32" HG VAC.- 4000 PSI
22546	MACHINED COLD ROLLED STEEL	4000 PSI - 12000 PSI



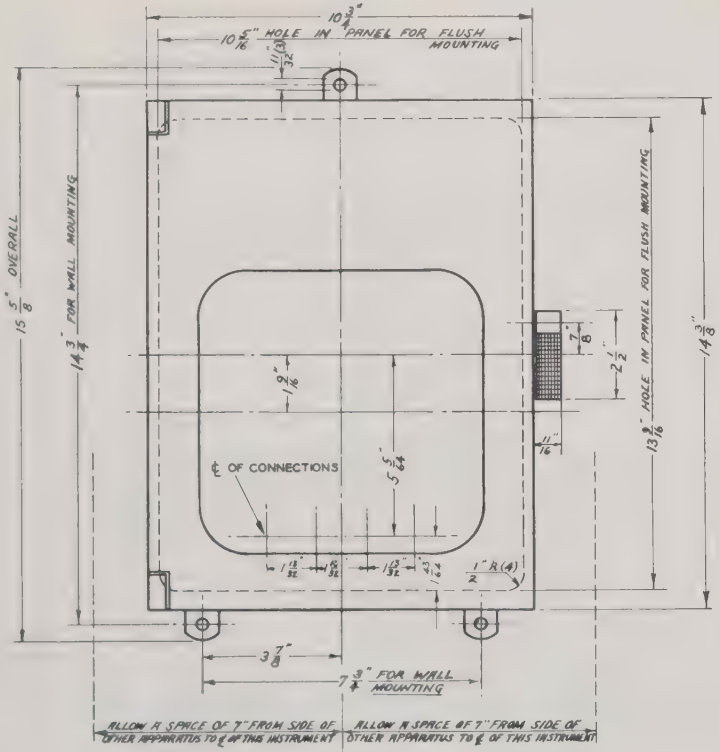
BOTTOM CONNECTED

BACK CONNECTED

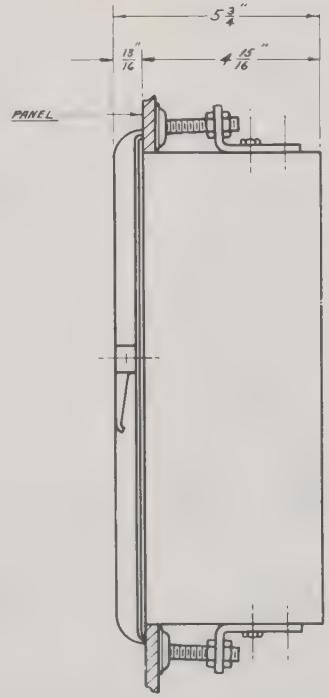


NOTE: PART NO. 22546 CAN BE FURNISHED AS REQUIRED FOR USE WITH STEEL ELEMENTS FOR CORROSIVE RESISTANCE.

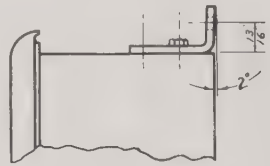
DO NOT SCALE THIS PRINT



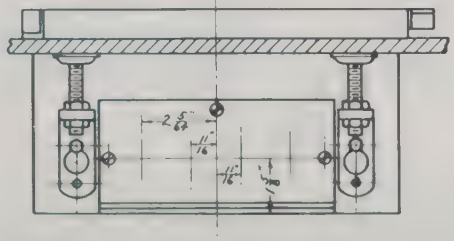
DETAIL OF FLUSH MOUNTED CASE



DETAIL OF WALL MOUNTED CASE



NOTES:-
1. FOR BOTTOM CONNECTED THERMOMETERS AND FOR GAUGES USING CLEANABLE DIAPHRAGM SEAL, INCREASE CUTOUT LENGTH TO 13 3/4" FOR TUBING CLEARANCE IF PANEL IS OVER 1/2" THICK.
2. MAXIMUM PANEL THICKNESS 1 7/8".



MOUNTING DIMENSIONS FOR 8" MODEL 500 CASE

See reverse side for 12" case dimensions

THE BRISTOL COMPANY
WATERBURY 20, CONN., U.S.A.

INSTRUCTION Y19809
Issue No. 4 of 4/53 PAGE 1

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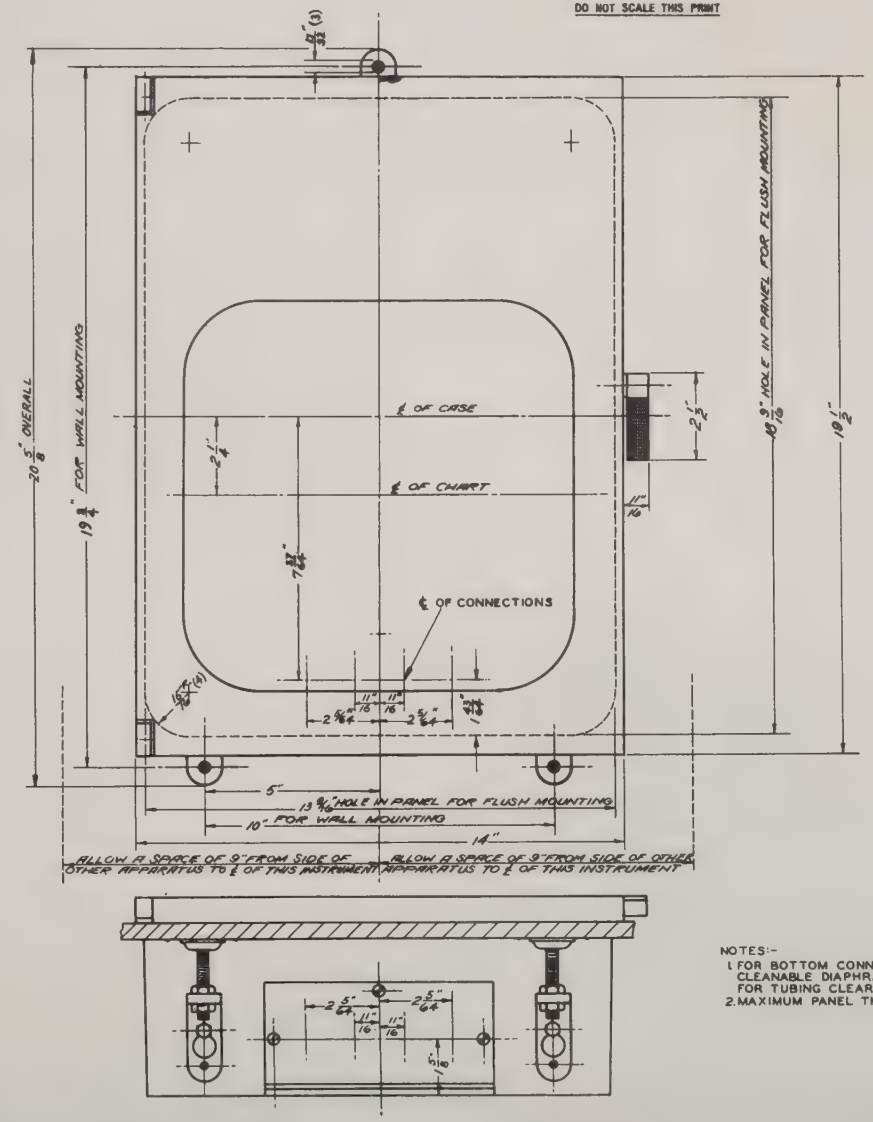
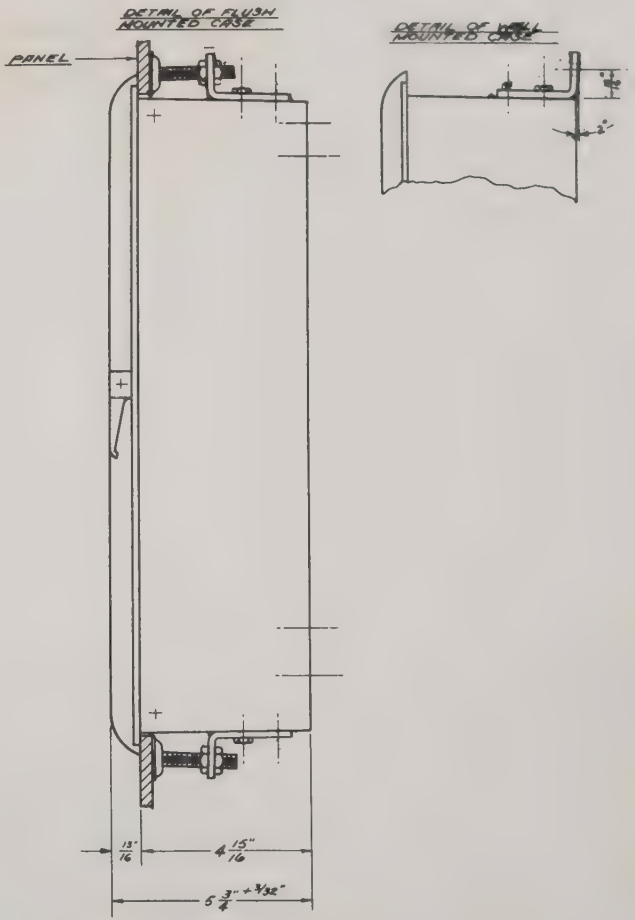
DO NOT SCALE THIS PRINT

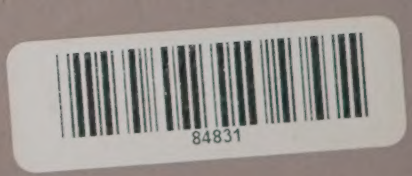

20 5/8" OVERALL
19 1/4" FOR WALL MOUNTING
℄ OF CASE
℄ OF CHART
℄ OF CONNECTIONS
18 3/16" HOLE IN PANEL FOR FLUSH MOUNTING
19 1/2"
5"
13 9/16" HOLE IN PANEL FOR FLUSH MOUNTING
10" FOR WALL MOUNTING
14"
ALLOW A SPACE OF 9" FROM SIDE OF OTHER APPARATUS TO ℄ OF THIS INSTRUMENT
ALLOW A SPACE OF 9" FROM SIDE OF OTHER APPARATUS TO ℄ OF THIS INSTRUMENT



NOTES:-
1. FOR BOTTOM CONNECTED THERMOMETER AND FOR GAUGES USING CLEANABLE DIAPHRAGM SEAL, INCREASE CUTOUT LENGTH TO 18 3/8" FOR TUBING CLEARANCE IF PANEL IS OVER 1/2" THICK.
2. MAXIMUM PANEL THICKNESS 1 7/8".

MOUNTING DIMENSIONS FOR 12" MODEL 500 CASE

See reverse side for 8" case dimensions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